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SHACKLES ON FOREIGN TRADE

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Shackles on Foreign Trading

By LEWIS E. PIERSON, Chairman of the Board, Irving Trust Company, New York

(Following is the text of an address given before the National Foreign Trade Council in New York on November 18 last)

THE recovery in business which has come to most of the great trading nations, including the United States, has brought a welcome relief from the distress and suffering experienced when business was declining, prices were in a state of collapse, and unemployment was increasing. Yet in order to view our business and economic problems realistically it is necessary to recognize that the recovery throughout the world has come through means which are not altogether satisfactory.

In some countries increasing business activity has been forced by public works expansion. In others, activity in connection with rearmament has been primarily responsible for the improved volume of business, and there are but few countries in which there has been a natural recovery free from artificial stimulation by governments.

One of the most significant elements in the situation has been the relatively smaller increase in foreign trading than in the purely domestic business of the major countries. Internal industrial activity for the leading nations was in 1935 almost 32 per cent higher than in 1932, while world international trade was in the aggregate only 10 per cent higher than in 1932.*

While it may be too much to say that business has progressed about as far as it can without the assistance of international trade on a broader scale, I am sure that we all will agree that recovery in foreign trading can provide a powerful stimulus to further expansion and can assist materially in creating an environment in which artificial assistance by governments can be withdrawn.

The need for foreign products has been intensified by long years of trade stagnation. In many nations demand for essential commodities from other countries has accumulated as restrictions have impeded the importation of such commodities. On the other hand, business in almost every country has suffered because of the accumulation of surpluses of their own commodities dependent primarily upon foreign markets for their disposal and also because of idle productive capacity dependent on such markets for its use.

It would seem that we have had only a foretaste of the economic and social dislocations which will result if international trading is to be severely restricted and if nations as a permanent policy continue to make themselves independent of foreign supplies of essential commodities, and, as a necessary result find themselves deprived of many foreign markets in which they previously sold their own surplus goods.

It is not because of a lack of facilities that foreign commerce is at such low ebb, for in every modern country the machinery exists for a broad resumption of foreign trading. The productive capacity is available. There are vast surpluses of unused plant capacity, and the ranks of the unemployed provide a great reservoir of labor awaiting employment in the production of goods for export. The modern facilities for communication and transportation are also at hand for this purpose.

It is not difficult to discover the explanation for the failure of foreign trade to advance commensurately with the recovery in domestic trade, for on every hand there is evidence that the many devices which have been created to curtail imports are reacting harmfully and also that the world is coming to realize that in reality these measures are proving to be a means for the self-strangulation of all international trading.

These devices have been described in considerable detail by foreign trade experts and economists, and there is of course no need for me to repeat what they have said. Rather I want to deal with some rather plain and unembellished first principles. I do so with no apology, for it is essential, particularly in the field of international relationships, that we keep major objectives clearly and firmly in mind.

Before dealing with the many shackles now imposed on foreign trading, I wish to pay tribute to the painstaking and intelligent efforts over a period of many years by the National Foreign Trade Council and by the International Chamber of Commerce to bring home to business interests as well as to governments the grave problem which trade barriers have created and to make available to interested parties a wealth of information on the question.

The present obstacles to international trading in the form which they now assume are largely of recent origin. Most of them have been developed since 1931, when the machinery of international credit broke down and debtor nations deemed it necessary to introduce exchange restrictions and other controls on foreign trade to protect their monetary systems. It was intended, undoubtedly, that these measures be temporary, to bridge over a short period until confidence could be restored and debt service resumed on a normal basis. But unfortunately they are still with us.

Some of the instrumentalities in this trade control were in existence before, while others have been invented since 1931. Of the old methods, tariffs is one that in many cases has been distorted as a means of trade control far beyond its normal function, which was to compensate for sharp differences in costs of production in different markets. Not only have tariffs been raised in many cases to prohibitive levels, but they have been made instruments of international political pressure through the application of different tariff rates to different nations. The efforts of some countries towards restraining and reducing trade by the manipulation of tariff rates and of methods for calculating them have assumed, in many cases, absurdly exaggerated forms.

Subsidies, as an instrument of trade control, also existed in the past, but had very limited application. They have now become an aggressive instrument for carrying a trade war into other nations' territory. Subsidies in their turn are likely to take many different forms, such as preferential tax rates, benefit payments and allowances of all kinds. As a result, the sale of goods in foreign countries at less than the cost of production is no longer an exception.

Another group of measures which represents a still greater menace to foreign trade has for its aim the complete control of the physical exchange of goods and the erection of walls that cannot be scaled. I have in mind import quotas and embargoes.

The import quota gives the government using it the power of keeping out of the country goods in excess of certain arbitrarily fixed quantities. The temptation to use this power for international political purposes and international log-rolling is ever present. I

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*Figures for Industrial Activity and World Trade from League of Nations.

have already mentioned that the old-time neutrality in tariff making has been abandoned by many countries. The application of quotas has led the world still further along the path of trade war and the subordination of economic necessities to political influences.

I do not know whether embargoes deserve a special place in this list of shackles on trade since, after all, an embargo is only a quota carried to its ultimate expression,--that is, when the quota becomes zero, it becomes an embargo.

One of the most onerous of the many shackles on foreign trading is found in the restriction of exchanges. Originally intended only to prevent the withdrawal of foreign credits and balances, the machinery of exchange restriction has grown to a point where it has substituted governmental control of foreign trade in its minutest aspects for the free play of economic forces.

The control of the proceeds of an export to insure that these proceeds are not diverted from the foreign exchange resources of the exporting country has become a control of the transaction itself, and has led to government supervision of the direction of trade, and even of the method of trading.

The control of imports for the purpose of insuring ability to pay for them in foreign exchange has also developed into a system of licenses so powerful as to determine not only quantities, but also sources of importation and, to some extent, the terms of the deals.

While on the subject of exchange restrictions and their unfortunate influence on foreign trading, I shall mention several methods which grew out of these restrictions and which are being actively used in many countries to divert and impede the flow of trade.

The methods I have in mind are those of barter arrangements, as well as clearing and compensation agreements which tend to regulate in great detail the exchange of commodities and the methods of payment.

As these various systems of trade control develop, there accompanies them a movement toward intense commercial nationalism frequently culminating in " buy national " movements and in propaganda which is designed to create in the public mind the impression that the purchase of imported merchandise is a form of national treason.

The variations of method of shackling foreign trade are many, and I will not attempt to list them all. However, just to give you an idea of the wide range of these restrictions, there are in addition to those I have already mentioned, discriminatory and double taxation of foreign enterprises, discriminatory incorporation laws for foreign establishments, patent and trade mark requirements which furnish insufficient protection for foreigners, excessive pure food and drug restrictions and quality standards designed to keep out foreign competition, unnecessarily stringent quarantine requirements on animal, fruit and vegetable products from abroad, limitation of public works material to domestic supply, unreasonable consular and other documentary requirements, and establishment of monopoly controls in particular commodities.

Quite apart from this list of the weapons with which nations attempt to control the free flow of international trading, there is another obstacle, less consciously applied which acts as an artificial restraint on trade between nations, and that is the uncertainty created by instability of currencies.

It was inevitable that the use of restrictive methods should breed reprisals and retaliation throughout the world. The measures of retaliation in turn tend to produce further application of still more severe restraints and controls, with the result that an endless chain of interferences with the flow of goods is constantly being forged and extended throughout the world. With this, the regimentation of economic activity must become greater. Industries which have been operating to supply foreign markets tend to become stagnant, and now industries which have no economic basis for existence tend to become established behind artificial walls. Nations attempt to produce goods which they have not produced before and for which they have always been regarded as unfitted, and to grow crops for which their territories are not endowed by nature.

If this movement is extended, still greater investment will probably be made for the production, in a synthetic way, of materials which are readily obtainable from other countries at considerably lower cost and which give much greater satisfaction than the synthetic product. These unsound activities cannot be undertaken by private capital on the basis of purely business calculations. By their very nature they must be fostered and subsidized and supervised by government bureaux.

Thus, regimentation which had its origin in attempts to control foreign trade may become part and parcel of the internal economic system of these nations and threaten a breakdown of the entire system of free enterprise upon which our material civilization has heretofore been based.

The sacrifices which nations undergo in producing at high cost those goods which, under normal conditions, could be cheaply bought abroad, result in a lower standard of living and in social strains and stresses which still further threaten the stability of our social system.

It is small wonder that the spirit of nationalism in foreign trade which has been transferred, as I have mentioned, to the field of internal production of synthetic materials or manufactured articles, has become a menace to international peace by fostering nationalism where it has no place, namely in trade and industry.

The threat to international peace involved in these barriers to normal trade relations between the nations of the world is sufficient reason for insisting that this problem shall not go by default, for the consequences may be too serious in terms of human welfare.

The trend of political and social affairs in the chief trading nations provides abundant evidence of the need for constructive action that will free the trade of the world from the shackles which mistakenly have been applied by depression-distraught governments.

Some of the devices I have mentioned may well have a place in modern industrial society, but it has been demonstrated that they can be over-developed and abused. The problem to-day is not so much whether they should exist at all, but rather how their effectiveness may be limited and how the abuses which have grown up under them may be eliminated.

If a nation closes its markets to foreign production through excessively high tariffs or through quotas or whatever other means of trade protection it may adopt, it merely penalizes its own citizens, for if import markets are closed, then export markets cannot long remain open.

No scheme has ever been devised whereby one nation can, over a long period, sell outside its own borders and at the same time refuse to buy the products of other nations.

So, instead of a protracted discussion as to the right and wrong means by which this problem can be solved, I would like to suggest that the leading nations without delay make some concessions on one side in order to obtain some advantages on the other, and compose their differences as to the type of measures to be taken in an effort to effect quickly some reduction in present-day barriers to trade.

The impassé in world trading has been a source of disturbance not only to the economic, but also to the social and political welfare of the world at large. The necessity is pressing and the time is propitious for action looking toward ameliorative measures.

Recovery has progressed in most countries of the world to a point where governments are beginning to find relief from purely economic pressure. The vicious spiral of deflation has been stopped. Prices, production, and employment are on the upgrade, and business improvement with re-employment has brought a condition in which governments should be able to consider, in the light of cold economic reality, what they must do in order to remove the shackles from foreign trading.

The problem is no longer one of forestalling deflation and economic disintegration, but of stimulating the upward movement which has been under way for some time and has now gained considerable momentum. An increased volume of foreign trading, more than any other factor, can provide means for an extension on a far sounder basis of the recovery in business, prices, and employment thus far experienced.

I have said that the need for action is clear and that the time is propitious, but I think that we can go still further and say that delay is likely to be costly. The longer these abnormal barriers to trade are permitted to exist, the more strongly will competitive situations become entrenched behind them.

Those industries whose competitive position depends on unduly high barriers to trade, naturally expect their governments to continue the degree of protection necessary to their existence. The more capital and labor are attracted into such unnatural situations the greater will be the losses to business and employment when such protection is later withdrawn.

It is essential therefore that these artificial means of obstructing the flow of international trade be restricted before undesirable and unsound situations gain too strong a foothold.

I do not want to leave the impression that I consider this problem a simple one, for obviously it is not. But its difficulty must not discourage nations from making an effort, and a prompt one at that, to remove some of the disadvantages under which foreign trade is being conducted. The problem affects more than one nation. Therefore, it is axiomatic to say that it will yield to solution only if the parties affected mutually agree to do something about it.

Any arrangements must, of course, provide not only for a reduction of the barriers to trade, but also assure stability of the exchanges, in terms of which trade must be conducted. International trade transactions require many days, and in some cases months, for thier completion, and international monetary arrangements should take this fact into consideration.

I want here to do no more than to point out that the problem of removing the shackles of trade should be treated along with the problem of introducing stability in the exchanges, for one without the other cannot be fully effective.

Removal of the shackles on foreign trading through international co-operation should well repay the world in terms of improved business, a higher standard of living, more tranquil political and social conditions, and lessened dangers of war. It is not too much to hope that the lifting of economic pressure which would follow removal of the obstacles to foreign trading might lead the world toward a period of unexampled prosperity. It is time for the leading nations to seek through co-operation and mutual concession a solution to this basic international problem.

Japanese-American Trade

By W. CAMERON FORBES

(Following is an address given before the Japanese-American Trade Council Session of National Foreign Trade Convention, Chicago, on November 19 last)

WHEN one comes to consider the business between Japan and the United States, one must bear in mind that the story of our trade with Japan is very largely one of textiles, and that by far the largest single item of these textiles in the imports to the United States from Japan is silk, and by far the largest item of trade in the exports of the United States to Japan is raw cotton. To be exact, Japan exported to the United States $152,000,000 worth of goods in 1935, of which silk accounted for $90,000,000, or nearly 60 per cent, whereas, of our exports from the United States to Japan of $203,000,000, cotton came to about $103,000,000, or a little over half.

These figures show a substantial increase in dollar value of goods shipped from the preceding year, and in 1936, for the only eight months of which we have record, the silk has maintained something like the same general proportion.

At the time of the visit of our Mission to Japan, the Japanese complained bitterly of the loss that their people were incurring by reason of the very low price they were receiving for their silk, which, coming at the same time we had artificial governmental action boosting up the price of cotton, brought about a very unfortunate situation in regard to trade balances, there being a trade balance against Japan of such serious proportions as to presage important remedial action. From the figures of 1935, this adverse balance of Japan's has been greatly lessened and, in the first eight months of 1936, the United States exported to Japan $115,000,000 worth of goods compared with imports of $108,000,000, so it would seem as though the normal course of trade bids fair to restore the balance to a more desirable trade relationship of exchanges of commodities on a fairly even basis, rather than, as was the case in 1934 and before, exchanges of commodities with a balance to be made up by financial adjustments.

But one should scrutinize these figures to get a comprehension of some of the basic facts, and a careful study of the United States' trade relations with Japan does not reveal a situation such as one might gather from the bare recital of figures giving totals. I refer to the Japanese invasion of United States markets with articles produced under conditions of capital, labor and output of their factories with which we cannot compete. I hold it as a fundamental postulate that the United States must produce, within its borders, a sufficient quantity of articles absolutely necessary for home consumption and defence in time of war and of stress, and it would be a suicidal policy for us to give up our home manufactures and means of production to any country, so that unless some devices can be conceived and entered into providing a reasonable limitation, either by agreement or by law, our people will sooner or later be forced to remedial action, which might take the form of exclusion or an impost of duties which would amount to practical exclusion. This matter was discussed, as I said in my speech last year at the Trade Convention in Houston, by our Economic Mission with the Textile Institute in Osaka, and we then ventured to make the suggestion that the Japanese should voluntarily increase the price structure, so that such imports as they send in should not be too upsetting to the business in which they participate, and that they, moreover, voluntarily limit the extent of this intrusion, so as to avoid creating a condition which would almost infallibly bring about a remedial action of a sort which would not be helpful to their industries.

In dealing with trade problems in the Orient at a trade convention in the United States, one is particularly desirous of avoiding everything that might be classed as political, and confine one's remarks wholly to the economic aspect, and yet there are political sides to economic problems and one cannot wholly discuss the economic aspects of a certain situation without touching upon their political side. It is my intention to emphasize the economic side of what I have to say, and dwell as lightly on the political aspect as possible, but I want to make a few remarks about the "Open Door" in China, which was a policy enunciated by John Hay, as we all know, accepted at the Nine-Power Treaty of the Washington Conference (1921-22), in which Japan, China, the United States and six European countries participated. And so the phrase "Open Door"—which meant free approach on the part of all countries to the markets of China on reasonably equal terms—was accepted, and became a by-word known the world 'round when trade matters were discussed.

I am sorry to say, however, that this policy of the "Open Door" does not seem to have been observed in the conduct of affairs in Manchuria under the general direction of Japan. While the door may have been open, as some observers have put it, someone stood in the door and only allowed to pass through the non-competitive things which they allowed to get through, and competitive things, i.e., things which competed with the Japanese industries, have had pretty hard sledding and some have been compelled to move out. I speak most particularly of financial institutions such as American banks, which have stopped doing business in Manchuria, and the oil companies. I do not want to dwell on this more than to say that if this policy is found to prevail where the Japanese extend influence into other provinces of China, as they have shown a tendency to do in the North of that harassed country, that there will inevitably be built up a greater and greater international resistance to this impediment to the freedom of trade, which is such an important part of world policy in the Pacific.

There has been some irresponsible talk of a possible war between the United States and Japan. War has become such a terrible thing and is such a poor agency of settling disputes that, from an economic point of view, both countries must necessarily lose much more than they will gain, and by that I mean that the resulting costs, both to the victors and to the defeated country, are so stupendous that nothing that they could gain in the matter of trade or privilege could compensate for the economic drain which a war under present world conditions would bring in its train.

The United States and Japan have no fundamental cause for war, or differences, which should not be easily settled about the council table, where men of patriotic fervor and broad-minded consideration for the point of view of the other side endeavor to reach

(Continued on page 91)

Rainbows in the Far East

By C. J. LAVAL

In the relations of China and Japan, it is evident that new things are taking form, common-sense is having a hearing, and hard practicalities are in the ascendant. Within recent weeks changes have come over the face of things, in Tokyo and in Nanking. Complete unanimity of viewpoint, of course, is lacking in both places, but something that approximates actual desire for the co-operation so long talked about of Japan and China for advancement of China's welfare has grown into a reality. The blunt positiveness of Japanese policy in China has given away to an altered approach that is tempered with a reasoned suavity, and the hard resentful resistance that the Chinese have manifested through recent years appears to be melting at length into a disposition to let bygones be bygones, for the time being, at least, with a realistic urge to get the best possible values out of a situation that can't be helped otherwise. For the first time, in a long while, it would seem that a solution of major international problems in The Far East may be found.

With the change of method that has taken form at Tokyo, it has been emphasized that basic tenets of Japan's policy remain unaltered—that Tokyo is yielding nothing. It is apparent, nevertheless, that Nipponese statesmen are going about the business in a new way, and it is seen, too, that this departure has won approval, not only in China, but also in London and Washington. Competent observers, such as Roy Howard of the Scripps-Howard newspapers, find a reason for change of Japanese viewpoint in the progress that China has been making herself and, particularly in the strides toward real unification of China that have been taken under the guiding genius of Generalissimo Chiang Kai-shek. Assuredly, the advancement in many fields that China has achieved in recent years has not gone unheeded. The extensive building of roads and railways, the growth of systems of communications and the development of industries all are unmistakable signs of progress that have kept pace with the growing power of the Nanking Government, and the extension of its authority throughout the country.

Assuredly many Japanese leaders have hoped for the emergence of a rejuvenated, unified China and have desired in all sincerity to deal with a strong government at Nanking rather than with a government lacking authority. This has been evident in the past in the note of exasperation to be found in expressions of Japanese leaders of other times who complained that "there was no competent government in China with which to deal." The material advancement that China has made in recent times, and the new access of power and prestige of the Nanking Government under Chiang Kai-shek, probably are indeed factors that have brought the changes of the present day, but it is quite certainly true also that the magic has been worked with yen and sen and dollars and cents. Leaders both in China and Japan are sufficiently clear visioned and hard-headed to see wisdom and profit in a change of the rules of the game that converts losses into gains for both countries.

Factors in the Occident

To a certain extent also the Japanese viewpoint may have been influenced by considerations outside of China. It has been said that adjustment of Sino-Japanese relations may be expected automatically to bring about adjustment of differences between Japan and the United States. Also the Japanese Foreign Minister, Mr. Naotake Sato, in the same Diet speech in which he asserted that his Government desired to deal with China on that "basis of equality," which China has so long sought, is heard voicing assurances to allay British misgivings. These things furnish basis for the hope that changed relations of Japan and China, based on a newborn spirit of cordiality, may mark the dawn of a brighter day for the whole Pacific situation.

The Japanese Foreign Minister makes frank admission of errors in past dealings with China and his utterances carry in their phrasing such a forthright note of candor that no room is left for any doubt whatever of the speaker's sincerity. Definitely he opposes a policy of inaction.

"The present deadlock," he said, became inevitable, but to do nothing about it would be to show no appreciation of the situation. Because of various complications since the Manchurian outbreak, however, it is exceptionally difficult to hit upon a capital plan in a day or a night to break through the impasse. To solve pending questions I think we shall have to start from a new point. I mean by this that negotiations must be taken up by various countries on the basis of equality. This is the normal international way; there is nothing new in it.

"People who forget this natural course tend to think of their superiority over the other party, and such an attitude always tends to hamper the restoration of international relations to normal. When we consider this we should ponder over the manner in which Japan has hitherto been thinking of relations with China. We should consider whether the Japanese have been associating with the Chinese in the above manner of relations. If all is forgotten about this point and a new start made I think I should like to open negotiations. This does not necessarily mean yielding or special dealing with the demands of China. It is quite a natural matter. China has hitherto complained with regard to the principle of equality, and the fact that it has been forced to voice such a complaint from time to time has been a great obstruction. I should like, in this connection, to give consideration to their demands, or vital interests, and negotiate with the Chinese on an equal basis, discarding such ideas as equality and inequality. From the standpoint of equality we should explain as thoroughly as possible what we, for our part, consider to be our vital interests. If negotiations can be resumed on such a footing, I feel like resuming them. I cannot say whether or not this would help greatly to break the deadlock, but I trust that it would do so.

"On such a basis I think that the substance of the negotiations would be changed in many ways and that things would become easier. In that sense I shall examine the China question in its entirety, the North China question, matters pending between the two countries and other matters, and I should like to negotiate with the Chinese, maintaining an attitude of full harmony as long as Japanese interests are not impaired."

Views Receive Endorsement

The sentiments that the new Japanese Foreign Minister expressed in this address and in later supplementary statements did not escape criticism at home. He was taking too bold a step, it was said, but it is specially significant that a measure of unmistakable endorsement of his utterances was given by the Japanese Minister of War, General Sugiyama and by Minister of the Navy Mitsumasa Yonai. Furthermore, marking another departure from methods of the past, it is known that there is much closer co-ordination to-day than has existed hitherto of the activities of those heading Japan's armed services with the efforts being put forth by the diplomatic branches of the Government. Some special meaning may be seen, too, in newly promulgated orders of the Tokyo War Office that are designed to prevent the airing of political views by military men. This seems to denote that the authorities of the Tokyo War Office, mindful of the series of interviews and published statements of Japanese Army men in China several years ago. have concluded that such statements—which provided splendid copy for news correspondents—did not prove helpful for the diplomatic exchanges of that time. The revised regulations closely restrict public utterances of military officers.

Those who have alleged that the course Foreign Minister Sato has marked out means only a reversion to the unfruitful conciliation policy that Baron Kijuro Shidehara pursued ignore important essentials. These critics fail to take into consideration the passage of time and the march of events in China. In the days of the Shidehara regime, the grip of the Government in China was a flaccid thing, and the authority of that Government was circumscribed within a small area and did not extend over various independent sections of the country. Some real basis then existed for the charge

that " there was no competent government to deal with in China." In the 'twenties China, disorganized and divided, was struggling internally against banditry, communism, natural disasters, and, torn with the strife of conflicting factions, was striving to find itself. The China that confronts Foreign Minister Sato to-day bears little resemblance to the China that Baron Shidehara sought vainly to placate.

The Economic Mission to China

An event that gives force to the views that Foreign Minister Sato expressed in the Diet was the visit to China in March of a special Japanese Economic Mission. This marked the return of a visit to Japan made, a little more than a year ago, by a Chinese Economic Mission. The Chinese gesture at that time led to the formation of the Sino-Japanese Trade Council which has achieved but little within the year of its existence. The nature and the identity of the personnel of the Japanese group that came to China give a particular significance to their visit, for it was composed of Japan's foremost financiers and industrial leaders and was headed by Mr. Kenji Kodama, former President of the Yokohama Specie Bank. Included in the membership of the Mission, besides Mr. Kodama were. . . . .

Mr. Noboru Ohtani, President of the Nippon Yusen Kaisha.
Mr. Keizaburo Kato, President of the Bank of Chosen.
Mr. Hyakutaro Miyakegawa, Advisor to the Mitsubishi Trading Company.
Mr. Seijiro Miyajima, President of the Nisshin Cotton Textile Company.
Mr. Reisuke Ishida, Managing Director of Mitsui Bussan Kaisha.
Mr. Shin Hori, President of the Nisshin Kisen Kaisha.
Mr. Ikuki Akiyama, Advisor to the Mitsubishi Goshi Kaisha.
Mr. Aiichiro Fujiyama, President of the Nippon Sugar Company.
Mr. Kyoichi Aburatani, Director of the Sino-Japanese Trade Association.
Mr. Otokichi Shoji, President of the Tokyo Cotton Textile Company, and Chairman of the Dai-Nippon Cotton Textile Association.
Mr. Kensaku Ohira, Managing Director of the Sumitomo Bank.
Mr. Ichiji Iio, President of the Dong Shing Spinning and Weaving Company.
Mr. Risaburo Toyoda, President of the Toyoda Cotton Spinning and Weaving Company.

It is to be noted that by any estimate these men are luminaries of the Far Eastern business firmament—the real architects of Japan's greatness, and men not given to wasting time with futilities. Their visit to China only gave emphasis to the utterances of the Japanese Foreign Minister, and the manner in which they were welcomed in China affords a fairly accurate estimate of the reaction in China to the altered attitude of the Tokyo Government. At Shanghai and at Nanking the highest dignitaries of the Chinese Government and the foremost Chinese banking and business men exerted themselves to give a hospitable welcome to the visitors. Through the whole period of their visit to China, in Shanghai and at Nanking, they were guests at one affair after another at which China's highest Government officials and the country's foremost business men were hosts.

In the welcoming address that he voiced to the visitors in Nanking, Generalissimo Chiang Kai-shek told the members of the Mission that China desires the friendly help and the advice of Japan. He likened the reconstruction movement with which his Government is engaged to the transformation that was begun in Japan in the Meiji era and he expressed the belief that, as the members of the visiting Mission all are industrial and commercial leaders in Japan, they will the more readily sympathize with the efforts that China is putting forth since they have passed through the same stage during the great Meiji reform movement. Generalissimo Chiang expressed the hope that his hearers would unreservedly criticize and point out faults of the economic and other reconstruction projects which are being carried forward in China.

Ready to Accept Guidance

" Chinese industrial circles," he assured the Mission, " will unquestionably accept their advice and will follow their footsteps so that China's culture and economy may rise on the same plane with that of Japan for stability of Oriental peace and welfare."

" Orientals," the speaker added, " should respect Oriental culture, and if Oriental nations do not have Oriental culture as their basis of work, they can never co-exist with other nations. The characteristics of Oriental culture are magnimity and morality. Oriental countries emphasize politeness and righteousness."

The Generalissimo recalled his stay in Japan when he met the late Viscount Shibusawa. He related that Viscount Shibusawa had presented to him a copy of a specially edited volume of "Analects," making particular mention at the time of one proverb : " Do not unto others what you do not want others to do unto you." The Viscount, he said, considered this an outstanding characteristic of Oriental culture. The Generalissimo then asked all to rise and observe silence for one minute in honor of the late Viscount.

Dr. Wang Chung-hui, Chinese Minister of Foreign Affairs, and Dr. H. H. Kung, Minister of Finance both were hosts to the visitors in the course of their stay in Nanking. In an address that he made, the Chinese Foreign Minister told his guests that the success of their Mission would not only benefit economic relations of the two countries, but might also mark the beginning of a new era in Sino-Japanese relations as a whole.

Before the departure of the members of the Mission from Nanking their leader, Mr. Kodama, expressed the belief that the welcome they had received in China " was no mere formality, as it came from the heart." He added that he was highly satisfied with what the Mission had achieved.

" I am convinced," he said, " that our aim of promoting goodwill was fully achieved, although our stay seemed too short. The purpose of the trip was to promote goodwill." He denied that his Mission's visit had any other purpose.

Chinese Writers Sceptical

It may not be denied that with regard to the visit of the Japanese Mission to China a tone that is sharply critical and sceptical was apparent in the Chinese press as a whole. Chinese writers, in general, took as the keynote for the views they expressed an opinion that was put forward in an interview by Mr. Sun Fo, President of the Legislative Yuan, who declared that " political obstacles between China and Japan must first be removed before Sino-Japanese economic co-operation can be realized." Leading Japanese newspapers responding to this Chinese viewpoint attacked the Chinese attitude of " putting political issues above all other considerations," and an editorial view published by the *Tokyo Asahi* that the effort of the Mission to China was " a failure " brought a swift reply from Mr, Kodama, head of the Mission.

" The *Asahi's* view," Mr. Kodama said, " is diametrically opposed to our impressions gained in Nanking and Shanghai, and to the spirit in which the Sino-Japanese conversations were carried on. Unfortunately, such an editorial is likely to invite popular misunderstanding. Actually, the Japanese and Chinese delegations to the meeting of the Sino-Japanese Trade Association have amicably exchanged frank views and regard with optimism the effects of the conference."

In reply to a question in the Japanese Diet, the Japanese Foreign Minister, Mr. Sato, asserted that the visit of the Japanese Economic Mission to China was " useful in deepening the mutual understanding of the true conditions in the two countries through personal contract between their business leaders. This contact," he added, " was especially significant because Japan's policy in China aims at cultural and economic co-operation before taking up political negotiations."

In presenting a Chinese view in connection with the visit to the Capital of the Japanese Economic Mission, the *Central Daily News* of Nanking, organ of the Government advanced four principles to govern Sino-Japanese co-operation, as follows :

First, that economic co-operation, to be pure and simple, must be carried out within the framework of Chinese law and administrative decisions.

Second, that technical assistance should, in no way, entail infringement upon China's sovereign rights.

Third, that Japanese aid in the improvement of Chinese agricultural products should lie in increasing their output, and under no circumstances should there be any conditions aimed at squeezing raw materials from China.

Fourth, that regarding Sino-Japanese trade questions in general, Japan must respect the existence of Chinese national industries

(Continued on page 101)

The Commercial Progress of the Crown Colony of Hongkong

By SIR WILLIAM SHENTON

(The following article is taken from *The Asiatic Review* for January, 1937. The author, Sir William Shenton, has been an unofficial member of the Executive and Legislative Councils at Hongkong since 1927)

THE great progress which the colony of Hongkong has made in the last ninety-four years is due largely to seven principal factors. First its geographical position, second its natural facilities as a port, thirdly the fact that it is a free port, fourthly that cargo can be handled there more cheaply than at any other port in the Far East, fifthly British enterprise, sixthly the appreciation of its facilities for trade by the Chinese, and seventhly that Hongkong, the Portuguese colony of Macao, and Canton have for the purposes of the free movement of the population and quarantine been treated as if they were one area, with the result that few restrictions exist.

The colony might well be described as a monument to British enterprise and Chinese co-operation. It consists of the island of Hongkong, a number of small islands and a portion of the mainland. It is situated in latitude 22 and longitude 114. The total area is 390 square miles. It is situated at the mouth of the West River Delta and thus taps the bulk of the trade of South China. It is in the direct line of shipping moving either to the north or the south. The total population is little short of a million according to the latest census.

It was acquired in three separate stages. In 1841 the island of Hongkong and a small strip of the Kowloon peninsula was ceded by China to the British Crown; this was subsequently in 1842 confirmed by the Treaty of Nanking. In 1860 another strip of the peninsula was ceded, and in 1896 a lease for 99 years was obtained of what is now known as the New Territories.

It is interesting to note how time often vindicates and confirms the view of the man on the spot. Captain Elliot, Her Majesty's Chief Superintendent in China at the time of the cession of the island and responsible for the negotiations, was not only recalled, but received a strong reprimand from Lord Palmerston because he had accepted the island of Hongkong and not insisted on receiving the island of Tinghai, in the Chusan group, whose facilities for shipping, at the present time, would have been quite useless.

The colony has, from time to time, gone through cycles of prosperity and periods of depression, but it has always emerged from the periods of depression stronger and more virile than before; there is no reason to think that what has happened in the past will not be repeated. The port is a natural harbor for shipping, and is capable of accommodating the largest ships that the world has yet seen. It has, and can have, no real rival in South China, because for the big draft ships the Portuguese port of Macao is too shallow, and the port of Whampoa, which is a few miles down the river from Canton, however much dredging may be done there, will always have to contend with the mud flats at the mouth of the Pearl River which cover a very large area. At the time when the colony was ceded Her then Majesty's Government, through Sir Henry Pottinger, the first Governor of the colony, and who was vested with plenipotentiary powers, declared that the port should be a free port, that the flags of all nations were welcome, and an undertaking was given that Chinese family customs and usages would be observed. The amenities and the possibilities were quickly recognized by the inhabitants of the Hinterland, with the result that large numbers of hard-working Chinese flocked to the colony, and on a barren rock there arose a great commercial city and a port which, a few years ago, ranked second in the world for tonnage, and even to-day after a period of depression, still takes fifth place. The annual revenue and expenditure of the colony from small beginnings has now risen to a figure in the neighbourhood of 30,000,000 Hongkong dollars. The taxation is moderate, consisting of a collection of 17 per cent on the assessed rentals, a reasonable tax on wines, spirits, beer, tobacco, opium and petrol, with an Empire preference in respect of motor-cars, wines and tobacco. There are, of course, the usual duties on land and commercial transactions, also certain harbor and light dues which do not appear exacting when compared with other ports.

The harbor, seen from the air, presents a picture of great commercial activity. The eye at once discerns about 50 ocean-going ships taking in or discharging cargo, three large, fully equipped dockyards, also innumerable wharves and godowns. The continuous in and out junk traffic would also be very apparent. Daily many ships arrive and depart from or to all parts of the world, and the colony is at all times in closest touch with the ports of China.

Owing to the joint British and Chinese enterprise, there is a railway running from the Kowloon Peninsula to Canton, from which city the recently completed Canton-Hankow Railway starts, thus bringing the colony into direct touch with the railway systems of China. The two railways are not yet linked up, but this can only be a question of time, because if Canton wished to get the full benefit of her enterprise, and prevent much traffic from being diverted north to the Yangtsze River, this linking up is essential. Canton will certainly be the chief gainer by the through communication. It might be suggested that the port of Whampoa, when completed, will cater for this traffic, but the probabilities are that the deep-draft ocean-going ships will always favour the port of Hongkong.

The completion of this railway now brings Hongkong into direct railway communication with Europe.

The colony for some time lagged behind in the matter of air services owing to difficulties in negotiations with China, but she has now offered her aviation facilities freely, and constituted herself a free port for air services in the same way that she is a free port for shipping. Imperial Airways from the south, the China American organization from the north, and Pan-America from the west have recently developed regular services, so that she is now in direct communication by air with the rest of the world. The Japanese appear to have negotiated some arrangement with the North China authorities whereby civil aviation privileges over parts of China have been obtained. Possibly the most-favored-nation clauses of the various treaties will be brought into play in this respect and general facilities granted to other nations. China is progressing with great rapidity in the matter of roads, and the date cannot be far distant when cargo from the colony will be taken by lorries, and passengers carried by buses, to many parts of China.

A matter of first importance has recently taken place in China —viz., the stabilization of her currency together with a very real effort at unification. This new departure has synchronized with the recent visit of Sir Leith Ross, one of Britain's leading financial advisers, to China, and Mr. Norman Young, of the British Treasury, to Hongkong. For many years the economists have advised along these lines, but ancient custom and vested interests made this very desirable change more than difficult. Formerly, weight and quality of silver was the basis of exchange, together with currencies varying from Province to Province and largely dependent on the value of silver from time to time.

The new system is gaining ground with the extension of the influence of the Government at Nanking. A new currency is being put into circulation whose value is more or less in line with the Japanese yen and consequently with sterling. The effect is that exports from China are finding a ready market, and the result an increased buying power for imports by the masses of China. The policy of Hongkong has been, as far as possible, to keep her currency in line with that of China, and she is already benefiting from the increased trade of that country.

The difficulties of trading in the past can well be imagined when it is remembered that within the past few years the value of both the China and the Hongkong dollar has fallen in rough figures from a sterling value of about 2s. to 11d., back again to over 2s. 6d., and down again to 1s. 3d. Circumstances such as these bring commerce to a standstill or a purely hand-to-mouth position, as no trader from day to day can take a view as to the future. Now all this is changed. The Hongkong Government have taken over the currency policy of the colony, stabilized the local dollar round 1s. 3d., and so it will remain subject to some worldwide currency arrangement or some very far-reaching catastrophe. The merchant to-day can gauge the future with reasonable certainty and enter into his transactions without fear that he will turn a profit into a loss because of the vagaries of exchange.

The visit of Sir Leith Ross has been followed by the appointment of Mr. Kirkpatrick, who formerly represented Preston in the House of Commons and who has had much previous experience of this kind of work, in control of a scheme for arranging export credits by the British Government similar to that which has been in force in respect of Russia for a considerable period to the great benefit of the trade with that country.

Too much importance cannot be attached to this appointment, which will undoubtedly substantially benefit and improve British trade with China. Hongkong itself offers great facilities for trade and commerce. Here, on the coast of China, with her teeming millions, exists a colony steeped in British tradition, with a labor population orderly and industrious in the highest degree, adequate facilities for all forms of commerce, together with a stable and certain Government providing all the amenities of modern life.

Within about 100 miles of Hongkong is the ancient Chinese city of Canton, ranking second in importance in the country, and whose progress along modern lines during the last 30 years has been most phenomenal. Here flows the West River, bringing with it the trade of South China ; here roads and railways branch out in all directions ; here have been built, in recent years, cotton, wool, silk, cement, sugar refining and many other factories on the most modern lines ; here live the most active and certainly the most progressive people in the whole of China.

Taxation in China is, of course, of vital importance to the trade of Hongkong. From 1842 to 1925 the tariffs affecting foreign trade were almost entirely regulated by treaty, but in 1925 China obtained tariff autonomy, since when she has been going through a period of transition in this respect. Like many other countries, she did not escape the infection of nationalism, with the result that many of the tariffs, imposed from time to time, have met with a great deal of criticism ; but it is to be hoped, and there are already signs in this direction, that the position is largely a process of trial and error, and that in due course she will evolve a system both for imports and exports to which foreign trade will be able to attune itself.

This problem is, of course, also bound up with the question of internal taxation on the movement of goods from place to place, and here again there is much room for improvement, but as the influence of Nanking spreads over the country so are the many obstructions gradually disappearing.

As a centre of commerce Hongkong will probably become more and more attractive to the foreign trader ; there the arm of the law is sure and certain, a contract made can be enforced and the facilities for arbitration are adequate in all respects. As extra-territoriality disappears and as China brings into force increased or new commercial taxes and other impositions on trade, bringing in their train the inspection of books and other impediments, so will the foreign merchant find his harbor of refuge in the colony and direct his operation from that center. Merchandise can there be stored for unlimited periods to await a propitious market at a cost cheaper than anywhere else in the Far East.

A matter which is of great interest to the port of Hongkong is the smuggling problem. The high tariffs imposed by China have made smuggling a most lucrative occupation, and the system has become so organized as to have developed into a highly technical profession with ramifications in all directions. No British colony desires its trade to be built up as the result of illegal traffic. Consequently the authorities at Hongkong for a number of years past have tried to come to an arrangement with the Chinese Government agreeable to all concerned, but until recently what suited Nanking did not necessarily suit Canton. Now that Nanking is to-day exercising a more direct control over Canton, the time seems ripe for some new move in that direction.

The smuggling into China has developed into three categories. There is first the smuggling up and down the whole length of the China coast brought about by the high tariffs. This consists merely of running the gauntlet of the Chinese Maritime Customs. It is almost entirely confined to the Chinese merchants who, having taken delivery of their goods, pay an organization a certain percentage considerably less than the Customs levy, and the organization in question then delivers the goods to their destination, making their own arrangements on the way. The island of Formosa is also a convenient center from which to carry on operations. It will be easy to realize the difficulty of the Chinese Maritime Customs when the coastline of China and the numerous adjacent islands are visualized. The second form is confined largely to South China and was brought about by the Southern authorities having adopted a policy of industrialization for which purpose they have built various factories. The materials have in many cases been brought in duty free, and where a factory, such as the sugar refining mills, finds insufficient raw material to work on internally, sugar has been imported from outside without paying the duty others would have to pay. This procedure might be considered as legitimate save that it robs the Customs of revenue on which much of the Central Government loans are secured. The third form has been taking place in North China and consists in running goods into North China without paying the regular duties, accompanied by armed guards of Koreans and persons claiming Japanese status from Manchoukuo, who compel admission at the point of the bayonet and claim immunity by reason of the extraterritorial rights and privileges claimed under the Tangku arrangement. This form of smuggling has been carried out on a large scale, but the position appears to have now improved having regard possibly to the strong protests of the foreign Powers.

The question might well be asked what evidence is there that Hongkong has a more prosperous future in front of her. The answer is not difficult to give, with the reasons therefor.

(1) The Government is now building new and much larger hospitals and schools. It is about to finish a vast water scheme, largely increasing the supply for the colony.

(2) The Hankow-Canton Railway has just been completed, which must bring much new trade to the port.

(3) Air traffic is just becoming a reality in the colony.

(4) The Hongkong and Shanghai Banking Corporation, one of the most powerful if not the most powerful banking institution in the Far East, has recently rebuilt its head office at Hongkong at a cost of something in the neighborhood of 10,000,000 Hongkong dollars. The building now compares favorably with any other buildings of its kind in any part of the world.

(5) The principal wharf and godown company has recently increased its pier accommodation for large ships and deepened the approaches.

(6) House building generally is largely on the increase.

(7) The currency position both in China and Hongkong has recently been stabilized and put on a level where China can compete in the world markets.

(8) The British Government will with the export credit policy substantially increase the trade between Great Britain and China.

(9) The great improvement in the good relations and general commercial co-operation between the British and the Chinese in the colony, brought about by a much better understanding of each other's point of view and fostered by the liberal policy of the secondary schools and Hongkong University, point in the same direction. There have also been goodwill visits exchanged between the commercial communities of Hongkong and Canton, which is quite a new departure. Perhaps the most important event in this category is the recent meeting of Generalissimo Chiang Kai-shek and H.E. Sir Andrew Caldecott, the present Governor of Hongkong.

These facts cannot be controverted, and show the confidence not only of the Government but the commercial men also in the future prosperity of the colony of Hongkong.

Japanese-American Trade

(Continued from page 87)

an amicable agreement. There are differences which have arisen in the past and which will undoubtedly arise in the future, such as those that bear on fishing rights off the coast of Alaska and elsewhere. There are problems in relation to the infiltration of Japanese influence into the Philippine Islands, where the United States might take a leaf out of the Japanese book and stand in the door, even though they have an "open door," thus by various devices excluding foreign goods from entering on a competitive basis with their own. But, as I say, peaceful solution of these problems would inevitably follow good statesmanship on both parts, and it would be poor statesmanship on both sides if peaceful solution were not found for their problems, so that I look with absolute confidence, under the high statesmanship which Secretary Hull of the present Administration has demonstrated many times, for continued friendly and profitable relations between the United States and Japan, amicable solution of differences, and that degree of confidence and mutual friendliness which should characterize the international relationship between two great, proud and friendly peoples.

The Growth of Manchoukuo

It was early in the spring of 1932 when the State of Manchoukuo first saw the light of day, and so full five years have since passed. The five years from 1932 to 1936 formed, so to speak, a period of initial construction for the new State, and the second stage of active construction started with the advent of 1937.

During the period of initial construction the necessary foundations were laid for the growth and development of national economics as well as politics in the young State. It appears that with 1937 fresh efforts towards the sound development of national economics on the foundations thus laid were actively started.

In a comprehensive survey of the industrial development of the country a writer in the periodical *Manchuria* points out that it is trite to say that the practice of national economics in the modern sense is possible only on a modern and unified State, for no sooner had Manchoukuo been born out of the débris of the 1931 Incident than she directed her efforts to the perfection in form and substance of the country as a modern, independent State.

The eradication of banditry was started immediately to restore peace and order throughout the land : the system of decentralized politics adopted by the ousted militarist régime was discarded, and was replaced by a system of centralized politics ; a modern military administration system was adopted along with an equally modern currency system.

In 1934 monarchical rule was proclaimed, followed by the re-division of the country into ten administrative provinces instead of four as in the past. On the other hand, the reform and unification of all Japanese political organs in Manchuria took place to enable them better to meet the demands of the new situation thus created.

The year 1935 saw the momentous declaration by the Tokyo Government of its decision to abolish Japanese extrality in Manchuria, though by gradual stages. This epochal Japanese undertaking is now making smooth progress towards completion. This fact affords evidence of the steady and wholesome growth of Manchoukuo as a modern, unified State bound with Japan by what is commonly termed " a relationship of indivisibility."

It need scarcely be said that the national economy of Manchoukuo is correlated inseparably with that of Japan. It is on this account that the construction of Manchoukuo's national economy has two phases—that is, positive construction undertaken with Japanese capital and internal construction started side by side with the former. The "internal construction" referred to above is synonymous with the creation of a modern market in Manchoukuo.

The promulgation soon after the establishment of the Hsinking Government of a modern law of weights and measures and the epochal purchase of the old North Manchuria Railway from the Soviet Union may be cited as facts evidencing the unification of the Manchurian commodity market. On the other hand, the Central Bank of Manchou was established, through which the multifarious currencies circulated in the country under the militarist régime were quickly unified into a standard national currency.

Yuan Pegged

Further, the currency of Manchoukuo was linked at par with the Yen of Japan. The Exchange Control Law was also promulgated. All these steps were necessary to lay the foundations for the establishment of a credit market in Manchoukuo. In this manner, Manchoukuo during a short period was able to cement the foundations of her national economy and politics.

Nowadays the economic relationship between Japan and Manchoukuo is generally called one of " bloc economics " under which, it is needless to explain, the untapped natural resources of Manchuria are to be exploited with Japanese capital and the two countries' economics to be co-ordinated.

In order, therefore, to understand how Manchuria's industrial development is progressing it is necessary to know in what department of industry Japanese invested capital is active. Before discussing this subject we must know how much Japan has invested in Manchuria since the 1931 disturbance.

According to unofficial figures compiled by the Japanese Finance Minister, about 20 per cent of the money which the Japanese Government has expended under the so-called Manchurian Incident item appears to have been absorbed by Manchuria as an " indirect investment." Although no accurate figure of this indirect investment is available, it will not be far from the truth to put this sum at about 200 million yen ; but in order to make explanation plain, this indirect investment will remain untouched.

Now a study should be made of the sum of Japanese capital directly invested in Manchuria in the form of corporation stocks, debentures and loans. The amount invested directly from 1932 to the end of 1935 is estimated at 740 million yen. To this one must add the amount invested during 1936, which, according to vernacular papers, is estimated at 282 million yen. It then follows that during the five years from 1932 to 1936 Japan directly invested the lump sum of 1,020 million yen in Manchuria.

In short, this huge amount of Japanese capital, which exceeds the billion-yen mark, is the driving factor of Manchuria's industrial development. It is pertinent to know in what departments of Manchoukuo's national economy this tremendous Japanese capital is active. To understand this point, the total amount of paid-up capitalization of corporations established during the period for the development of enterprises in Manchuria must be examined.

Classified according to kinds of industry, the enterprises in which this capital was invested are in order : electrical enterprises ; iron, steel and machinery production ; traffic and communications ; banking and credit ; mining : chemical enterprises. Speaking generally, however, the industrial development of Manchuria is advancing on two fundamental principles, namely (1) the exploitation of iron, coal, farm produce and other materials of fundamental importance for industry ; and (2) the construction of railways and communication facilities as the vital power for the former.

Mineral Resources

First of all, the exploitation of mineral resources should be discussed. It is unnecessary to state that iron and coal are the two most important minerals in Manchuria. The total known deposits of iron ore in the country are put at 1,300 million metric tons, but this figure does not include the amount of ore in prospective mines in the Tungpientao and other districts which are now being surveyed.

It is interesting to know how much pig-iron can be taken from this huge iron ore deposit. In 1935, 600,000 metric tons of pig-iron were produced, the larger part of which came from the Showa Steel Works and the Penhsihu Iron Kungssu. An important point to be noted is that the iron industry of Manchuria has made astounding progress since June 1935, when the Showa Steel Works, the biggest of its kind in Manchuria, greatly increased its production of iron and steel.

Around the Showa Steel Works several gigantic factories to produce iron and steel manufactures have been built, including the Anshan Kozai (Steel Material) Company the Manchuria Rolled Iron Manufacturing Company and the Sumitomo Kozai Company. Ten years ago, in 1926, the country produced only 190,000 metric tons of pig-iron. That the output has quadrupled in ten years is mainly due to the efforts of the Showa Steel Works, an affiliated corporation of the vast South Manchuria Railway Company.

Next, coal, which is as important a mineral as iron, is produced in abundance at Fushun, Hsian, Peipiao and many other scattered points throughout the country. The total volume of coal still deposited in mines already under operation is estimated at 5,000 million metric tons, which, however, does not include the deposits of undiscovered mines.

The combined annual output of coal by the Fushun mine, run by the South Manchuria Railway Company, and the three principal ones managed by the Manchuria Coal Mining Company, namely, the Fuhsin, Hsian and Peipiao mines, is about 10 million metric tons. Considering that the figure in 1926 was 7 million metric tons, it must be noted that coal production in Manchuria has also made phenomenal headway.

The production of iron and coal is of primary importance for the industrialization of the country. Speaking more plainly, all industrial enterprises are based on the ample production of iron

and coal. Prominent among the enterprises thus started in the country of late is the liquefaction of coal for the distillation of oil.

Oil Shale Abounds

No oilfield has yet been discovered in Manchuria, although prospecting work is being continued. But this is well offset by the fact that the land abounds in oil shale, whose total deposit is estimated roughly at 5,400 million metric tons. Yearly 3 million metric tons are being exploited, from which approximately 87,000 metric tons of oil is being distilled at Fushun. The oil liquefaction enterprise, as is well known, is vitally linked with the solution of the Japanese Empire's fuel problem. Lately, this enterprise is about to be started also in the vicinity of Ssupingkai.

In connection with the fuel production industry mention should also be made of the Ta Tung Alcohol Distillation Company, which is producing alcohol on a large scale. Another point that must not be overlooked is power production. Needless to explain, electricity is the most important motive power for industry. All electric power enterprises in the country are under the unified management of the Manchuria Electrical Industry Company.

The present output of electricity in the country is 450,000 kilowatt volts, the major portion of which is being generated by caloric force. In 1926 the output was only 290,000 k.v., and it may thus be said that electricity generation in Manchuria has developed in a surprising manner. But the fact should be remembered that the limitless sources of power available along such big rivers as the Yalu and Sungari are still untouched.

As these power sources will be gradually utilized for the generation of hydro-electricity, the power industry in the country is assured of phenomenal development in the near future.

Turning to the chemical industry, the production of nitrogen is the most important enterprise, for which the Manchuria Chemical Industry Company is renowned. Besides, soda and pulp production is the latest enterprise commenced in Manchuria of late. As regards pulp production, the total acreage of forests in the country is put at 22 million hectares, from which upwards of 10,000 million Japanese koku (1 foot by 10) of lumber can be obtained according to estimates by experts. Because of this fact, the rapid development of the pulp production industry is a crying need.

Agriculture

Soya beans are the most important of all the staple farm products which the country yields, their annual output averaging four million tons. Setting aside soya beans, Manchoukuo is now directing her efforts to the encouragement of the cultivation of wheat in North Manchuria, cotton in South Manchuria, and hemp in both.

At present Manchuria yearly produces a million tons of wheat, but a plan has already been launched to double this output to two million tons within a period of 20 years. The Liaoyang and Haicheng districts are widely known for cotton growing. The yearly output of cotton is 64 million lbs. The cultivation of hemp throughout the land is now making astounding progress, tissues manufactured from this plant being about three million lbs.

Speaking of livestock raising the country at present has approximately two million sheep, five million hogs, about a million head of cattle and two million horses. Strenuous efforts are being made to improve the live-stock industry through the employment of many effective measures, including the establishment of large-scale facilities for the eradication of various animal epidemics indigenous to Manchuria.

Of course, for the exploitation of the country's agricultural resources the development of productive facilities already under operation is necessary, but the fact should not be overlooked that equal attention is given to the cultivation of so-called "sleeping resources." For this purpose, the working of fertile though uncultivated districts in North Manchuria, covering a wide area of altogether 16 million Japanese cho (one cho is equivalent to 2.45 acres), has already been planned.

For this great undertaking farm immigrants must be invited. The policy of Manchoukuo in this regard is to encourage the inflow of Japanese farmers by restricting the Chinese. An ambitious plan to invite a million Japanese farm households in 20 years is already in progress. This huge host of Japanese will settle down in the North Manchurian districts lying uncultivated at present.

The cultivation of these fertile, virgin districts is associated closely with the perfection of railway traffic. It need hardly be said that the perfection of modern railway communications is a vital factor for the exploitation of resources which are of fundamental importance. The combined length of the new railways installed in Manchuria from the advent of the Hsinking régime to November 1936 was 3,100 kilometres.

Relatively short though this length may appear to the average mind, it equals the distance from Wakkanai, a town in Hokkaido Island, southward to Kagoshima, the southernmost town of Kyushu Island, by way of Hakodate, the Tsugaru straits, Aomori, Sendai, Tokyo, Nagoya and Kyoto. When we study this point we can clearly understand the length of 3,100 kilometres.

When railways laid before the establishment of the new State are added to these new lines, the total length is 9,300 kilometres, including 1,700 kilometres of the old North Manchuria Railway transferred from the Soviet Union. In addition to this network of railways, the ports of Yuki and Rashin in North Korea have been opened for the facilitation of traffic to and from Manchuria. Furthermore, regular air-routes measuring 5,700 kilometres are maintained, while the length of telephonic cables traversing the length and breadth of the country is 45,000 kilometres.

Japanese Capital

Notice must be taken of the fact that more than 70 per cent of over 1,000 million yen of Japanese capital invested in Manchuria during the past several years has been invested through the South Manchuria Railway Company, largely in the construction of railways and the exploitation of important industrial raw materials. Naturally, whether the South Manchuria Railway Company is sound or not is a question weighing vitally upon the development of Manchuria or of Mongolia.

The Manchoukuo Empire has achieved surprising progress as a modern State. Lately, the Industrial Bank of Manchou has been created to play an important rôle in the industrial development of the country in concert with the Central Bank of Manchou. The time is now ripe for the Manchoukuo Empire and the South Manchuria Railway Company to join hands for the progress of the second stage of Manchurian national construction commenced with the current year.

In connection with this second stage of construction, particular attention should be given to three points. The first is the need for the further development of the exploitation of important mineral resources. A certain prominent German scholar once said that the soundness of a nation's industry can be gauged by its output of mineral products. In consideration of the current international situation, this need is all the more urgent.

The second point to be noted is in regard to the cultivation of the untapped districts in North Manchuria. The exploitation of agricultural resources, and especially of those considered of importance from the point of view of national defence, is a crying need. In this sense the importance of the announced invitation of a million Japanese households into these districts can hardly be exaggerated too much.

The cultivation of these districts is also a matter of importance for national defence and is closely related with the railway lines installed to date. Whether, therefore, the South Manchuria Railway Company is sound or not, it is a vital factor in the development of Manchuria. Inasmuch as the operation of railways is the principal business of the company, how these railways can be run on an economical basis is a matter of concern not only to the company itself, but is a question vitally bearing upon the development of Manchurian economy.

From this perspective the cultivation of the North Manchurian districts referred to above carries tremendous significance from the national standpoints of both Japan and Manchoukuo. The third point is that in order to meet the rapid development of industrial enterprises in Manchuria a fundamental and systematic farm policy should be adopted.

Since agriculture is one of the most important foundations for Manchuria's national economy, the development of Manchuria hinges to a large extent upon the progress of the country's farm production capacity. A solution of the farm question is the key to the perpetuation of the well-being of the Manchurian agrarian masses. Thus, the necessity of formulating a right and systematic farm policy is thus absolute. To speak more plainly, a correct solution of the farm question is a vital *sine quâ non* for the lasting prosperity of Manchoukuo.

The Manufacture of Electrical Equipment in China

By C. W. YUNG

The following is a paper read before the Institution of Electrical Engineers, China Center, at a joint meeting with the Engineering Society of China, February 8, 1937.

With the several increases in import tariff during the last ten years or so and the growing industrialization of the country, there has been a very strong impetus to manufacturing activities in China. In the electrical engineering field, the variety of equipment and apparatus now being manufactured and produced in this country covers a wide range from such heavy machinery as power transformers, alternators and motors to scientific instruments, lamp bulbs, switches and domestic appliances. The present paper is a brief survey of the electrical manufacturing progress in and around the vicinity of Shanghai, as owing to the rather limited time available, it has not been possible to visit and collect data on similar activities at other important trade centers of the country. There are, it is known, a number of plants, either connected with railways or some other government bureau, in Canton, Nanking, Tientsin and elsewhere engaged in the making and assembling of wireless sets, telephone switchboard, plating dynamos, etc. However, as the bulk of commercial activities centers around Shanghai, due to the ease of importation of raw and semi-finished materials and trading facilities, this paper makes no pretence to cover all the manufacturing in China of electrical materials.

As early as some thirty years ago, the Chinese Government were even then contemplating the manufacture of telephone and telegraph instruments by entering into an agreement with an American Company. Nothing more has been heard of this venture, although a factory did exist some years ago in Chapei. Later, another government scheme was projected, this time, with a Japanese firm for the making of electric wires and cables, but which also did not bear fruit. While there have been many Chinese financiers and pioneers in the establishment of cotton mills, flour mills, oil mills and other industries, it is singular that, up to the last few years, there has been hardly any industrial magnates entering into the field of manufacturing electrical equipment, diversified as the scope is. With a few recent exceptions, most of the plants have been started by some far-sighted mechanics and fitters and by the simple and most expeditious method of copying some existing equipment. Such being the case, limited in financial resources and technical assets, these pioneers have made a wonderful record out of crude tools and against keen competition from abroad; their product being none too good during the early start. The period of the following survey covers approximately from 1920 up to the present.

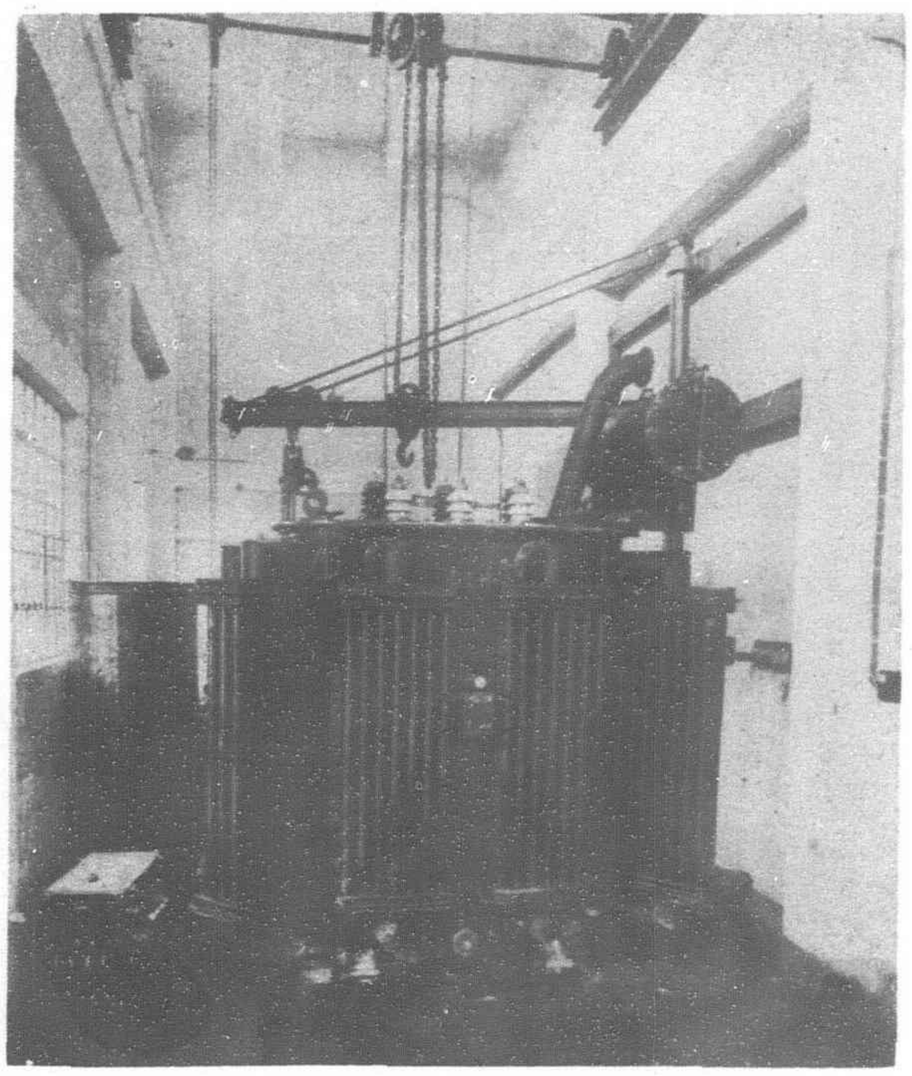


Fig. 1.—2,000 kva transformer, 33,000-volts primary

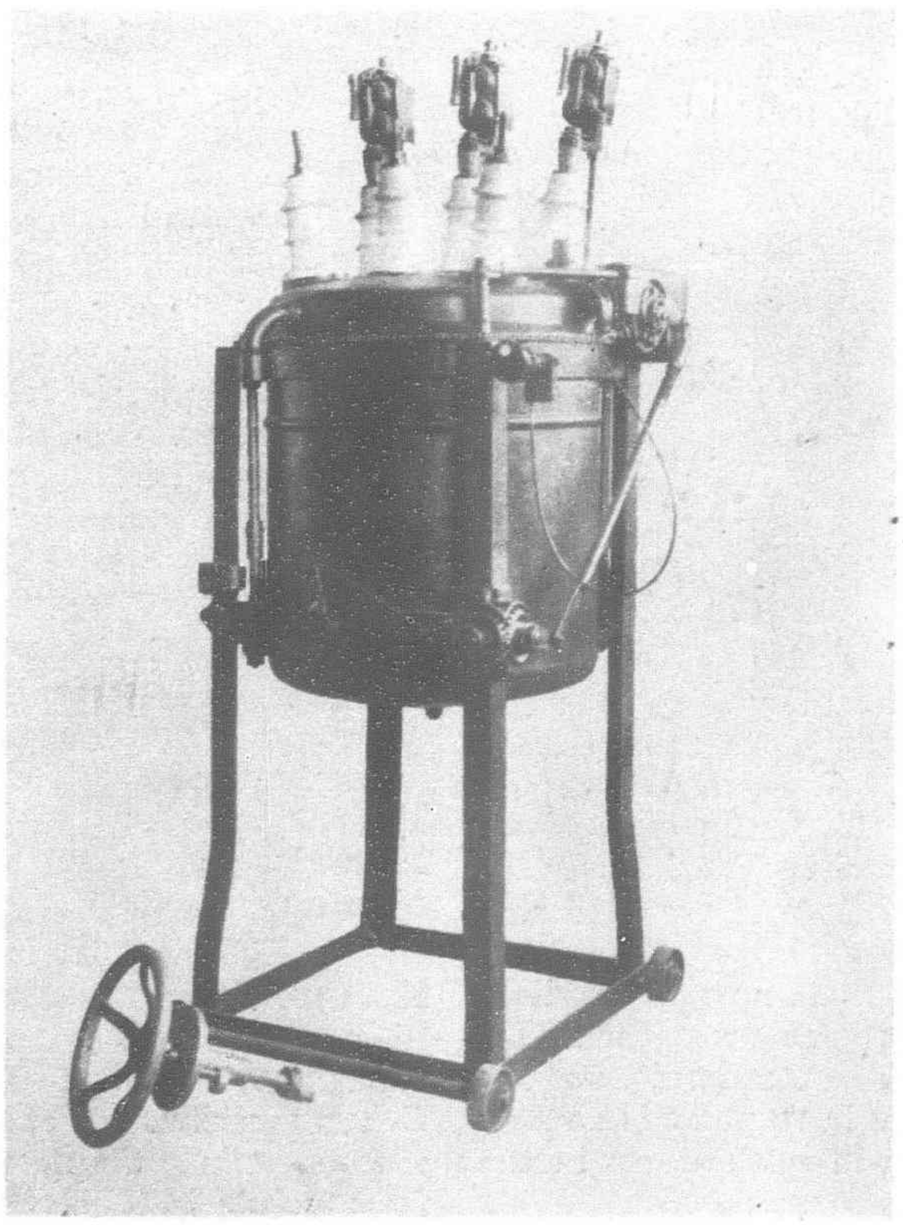


Fig. 2.—32 kv oil switch

Power Equipment

There are at present three large concerns manufacturing power transformers, with capacity as large as 2,000 kva and voltage as high as 33,000-volts. Due to the wide expansion of the electric supply companies, this trade has developed rapidly. It is estimated that these three concerns have turned out, during the last 15 years, an aggregate of approximately 5,080 transformers, totalling 363,825 kva. Locally manufactured transformers are extensively used by large public utilities such as Hangchow and Nanking and consequently, only very large transformers are imported nowadays. The steel sheets used for the core plates are imported mostly from U.S.A., England and Germany. Winding wires are chiefly supplied from U.S.A. Insulators are of local make, but for high tension work, American, British and sometimes Italian makes are still imported. Regarding the quality of these transformers, the following technical data illustrate the general trend.

TRANSFORMER TECHNICAL DETAILS

Continuous output, kva			1,000
Normal primary line pressure			5,500
Normal secondary line pressure at no load			380/220
Number of phases			3
Frequency			50
Primary/Secondary connection			Delta/Star
Double or Auto wound			Double
Primary tappings			5375, 5250, 5125, 5000.
Tappings to oil level or outside tank			Inside
Tappings arranged for constant output			Constant output.
Secondary neutral			Brought out.
Core loss at normal primary pressure			3,200 watts.
Copper loss at normal full load U.P.F.			11,500 watts.
Regulation at normal full load and U.P.F.			1.26%
Regulation at normal full load and 0.8 P.F.			3.77%
Impedance pressure at normal F.L. and ratio			4.80%
Efficiency at U.P.F.	Full load		98.55%
	¾ ,,		98.70%
	½ ,,		98.80%
Performance reference temperature			75°C.
(x) Normal maximum full load temperature rise by thermometer—			45°C.
Maximum ambient temperature			40°C.

Maximum percentage overload capacity with ambient temperature not exceeding 30°C.		*Cold (a)*	*Hot (b)*
Continuously		10	10
For 2 hours		50	25
For ½ hour		100	50

Polarity .. .. .. Subtractive.

(x)=Temperature rise by resistance is 50°C. greater.

(a)=Permissible overloads starting with transformer at atmospheric temperature.

(b)=Permissible overloads starting with transformer at normal full load temperature.

TRANSFORMER CONSTRUCTION DETAILS

Continuous output kva	1,000
Type of transformer core	Cruciform
Type of tank	Tubular
Method of cooling	Self-cooled.
Type	Indoor.

Terminals through tank cover or side H.T.	Cover.
Terminals through tank cover or side L.T.	Cover.
Type of H.T. terminals	Stud.
Type of L.T. terminals	Busbar connection.
Rollers	Supplied.
Oil conservators	Supplied.
Calcium breathers..	Supplied.
Tappings switch	Supplied.

APPROXIMATE NET WEIGHTS

Transformer core and windings	6,000 lbs.
Tank and fittings	4,300 lbs.
Oil	3,200 lbs.
Total net weight	13,500 lbs.
Quantity of oil	430 U.S. galls.
Quality of oil	BESA B.
Approximate overall length ..	78″
width ..	42.½″
height ..	110″

With the present tendency towards centralized and larger generating plants, a very limited number of small alternators and direct current dynamos are built. The largest that has been built is of 200 kva for use in Szechwan. However, a number of small direct current plating generators have been manufactured.

Concerning switchgear, the first piece of such commercial equipment was a copy of a very well-known British oil switch. Since then, this same switch has been imitated by many others, and switchgear in general has improved in quality gradually and some bear a very smart appearance, as shown by the photographs reproduced here.

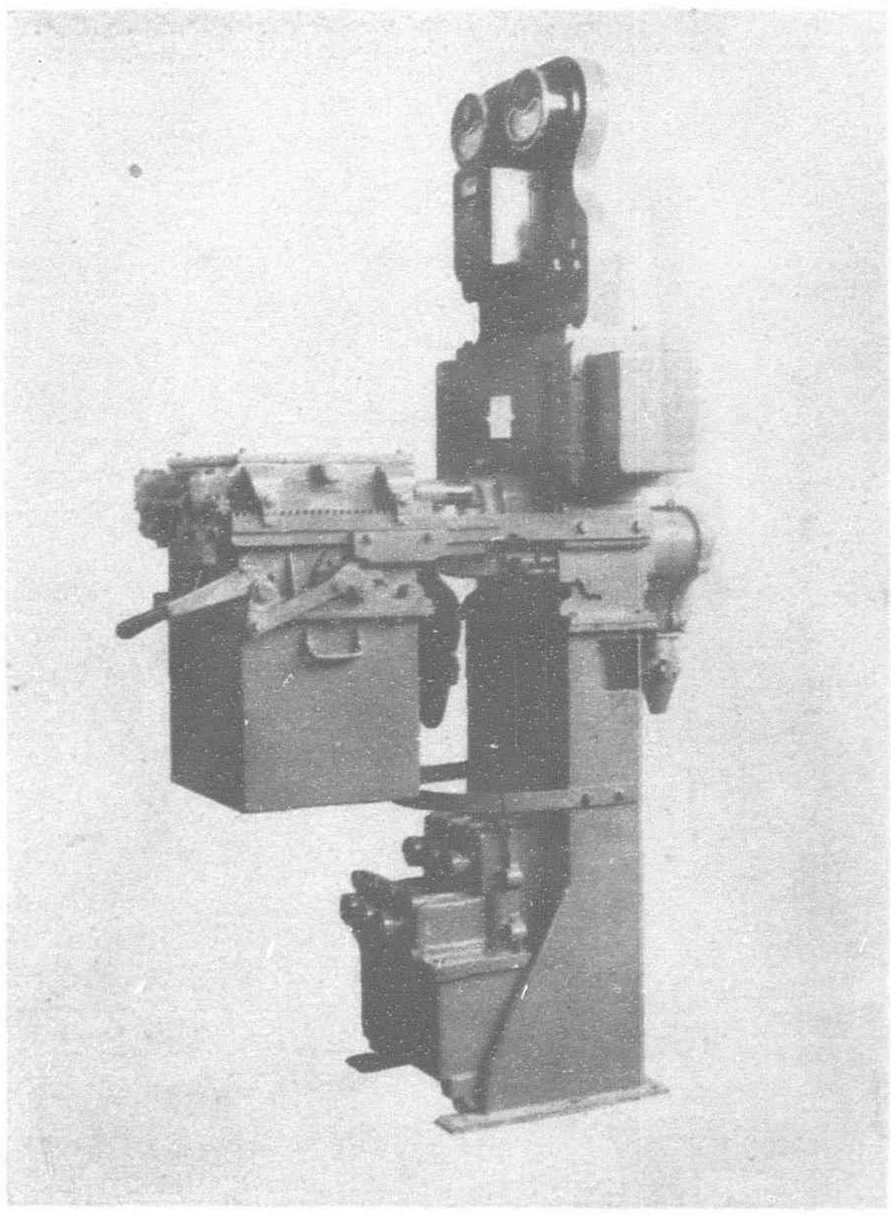


Fig. 3.—6,600-volts metal-clad switchgear

One of the photographs shows an on-load tap changing switch for a 400 kva transformer for furnace load, it being of the remote control type and capable of handling from 700 to 4,000 amp. It is rather unique, in that it is the first of its kind ever made in China. Other equipment, such as lightning arresters, high-tension switch-fuses, isolators, etc., are also being made. One line of manufacture which has been rather successful is a certain make of neon-sign transformer, the quality of which is so excellent that it has almost entirely replaced imported ones.

Insulators for electric light fixtures and low tension work have been made for some time, while high tension insulators for transmission lines and also for wireless transmission bushings have recently also appeared on the market. There is also a concern here making high tension insulators for transformers.

Insulators for telephone and telegraph lines are also made here in Shanghai, but I understand that the insulation value is very low and the useful age very short. Suitable clay and other raw materials are readily obtainable and it is hoped that this industry will develop rapidly when the art is better understood and controlled. Already importation of electric glassware and reflectors has almost ceased ; the market being filled with local make.

No plant has so far been projected or established for the drawing of copper wires and cable manufacturing, although the matter has been under consideration for several years by one of the Government Commissions. The latest contribution in the direction is a plant for the drawing of iron wires from billet and galvanizing it ; the bulk of which is used for telegraph lines, guy wires and binding purposes.

Many of China's old implements are now being motorized. Even the humble stone mill that grinds bean curd and the treadle pumps along the country-side have coolie labor replaced by electric drive. The boy that pulls and pushes the oblong box-shaped bellows in the blacksmith shop is gone, his place is now taken by a motor driven blower. Therefore it was only natural to expect an active business in motor making. There is a plant near Shanghai, specializing in A.C. motors, turning out a fairly presentable article. Although it has only been established for about three years, they have sold nearly three thousand motors of sizes up to 60 b.h.p. The plant is now being extended to manufacture motors up to 200 b.h.p. The National Government has also a plant in Shanghai for making motors but which, at the present, is under reorganization for active service.

It is felt by all concerned that, in the making of all electro-magnetic machines and apparatus in China, the supply of steel sheets for cores and copper wires for windings are dependent upon foreign import and that it is imperative that China should have her own steel mill and wire drawing and cable manufacturing plant. Right at the present moment, several electrical equipment manufacturing plants are idle because the steel sheets ordered from U.S.A. have been lost, the carrying steamer having caught fire. No doubt, in time to come, some such plants will be established. And, when that time comes, it is certain that China's electrical industries will be still further expanded and developed.

Wireless Equipment

Considerable progress has been made in this line during the past fifteen years. This activity can be roughly divided into two classes, namely, those who manufacture parts for the amateurs and the others who build transmission sets for broadcasting stations, Government Communication Stations, portable army sets, transmitting and receiving sets for aeroplanes, etc. There must be a considerable number of "Radio Bugs" and "hams" in this country since the volume of business transacted in wireless parts, such as valve base, condensers, speakers, coils, etc., runs into considerable sums of money. Two of the leading makers in this line report a combined annual turnover of over Chi.$600,000.00. The bulk of this trade is for the interior where battery sets are still in vogue because of the absence of electric current, either wholly or during day time.

Prices of these parts are very low and comparable to Japanese makes. An audio-transformer can be had for as low as thirty-five cents, a loud speaker for five dollars and a single tube set for eight dollars including a head telephone. Of the materials used, wires and steel sheets are invariably from U.S.A. as well as aluminium sheets for condensers ; brass rods and magnets from Germany. One of the largest makers even mould their own bakelite parts.

Of the other class, activity is centered toward transmitting sets for broadcasting stations, etc., and many Government and private stations are equipped with locally built sets.

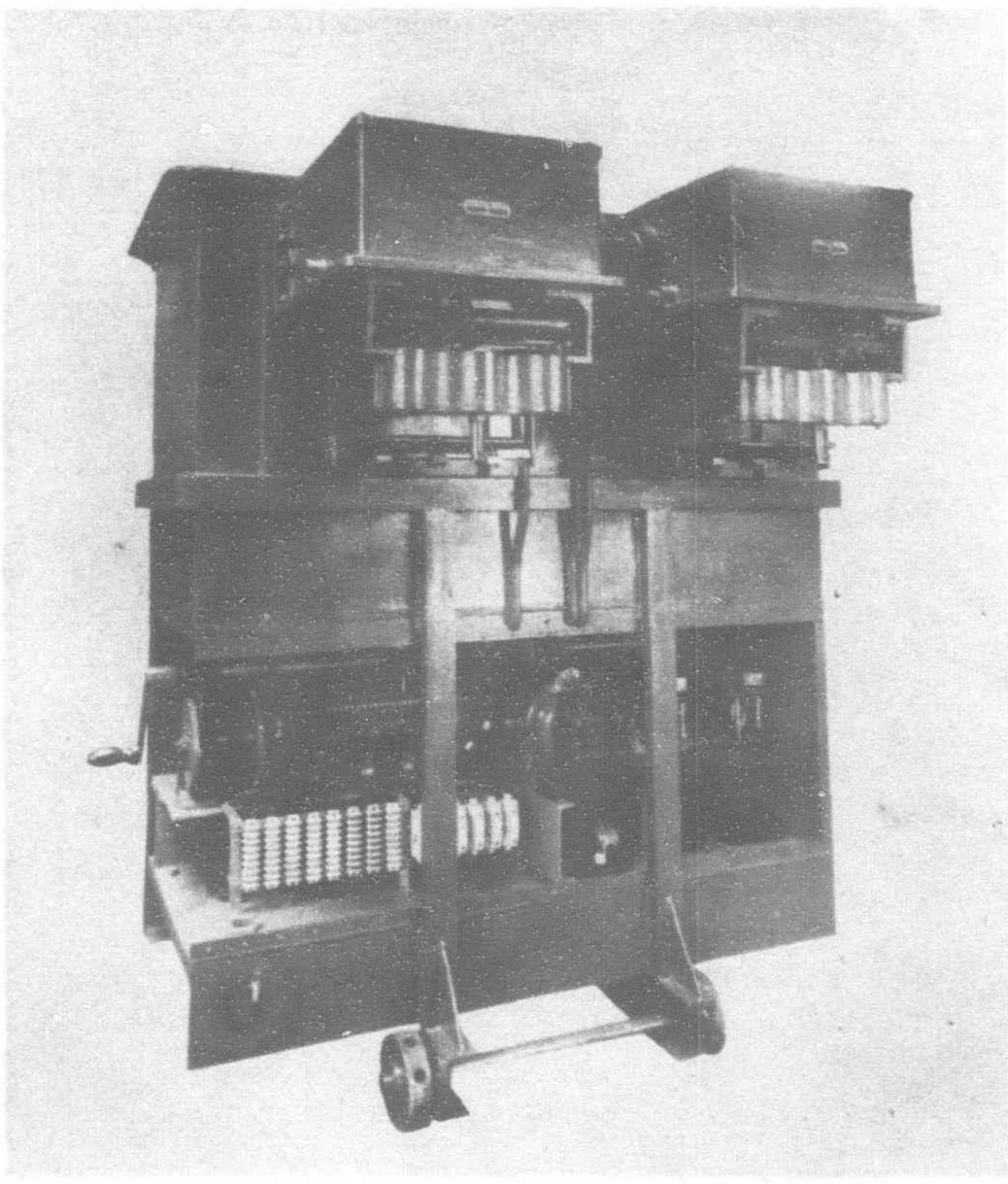


Fig. 4.—On-load tap changing switch

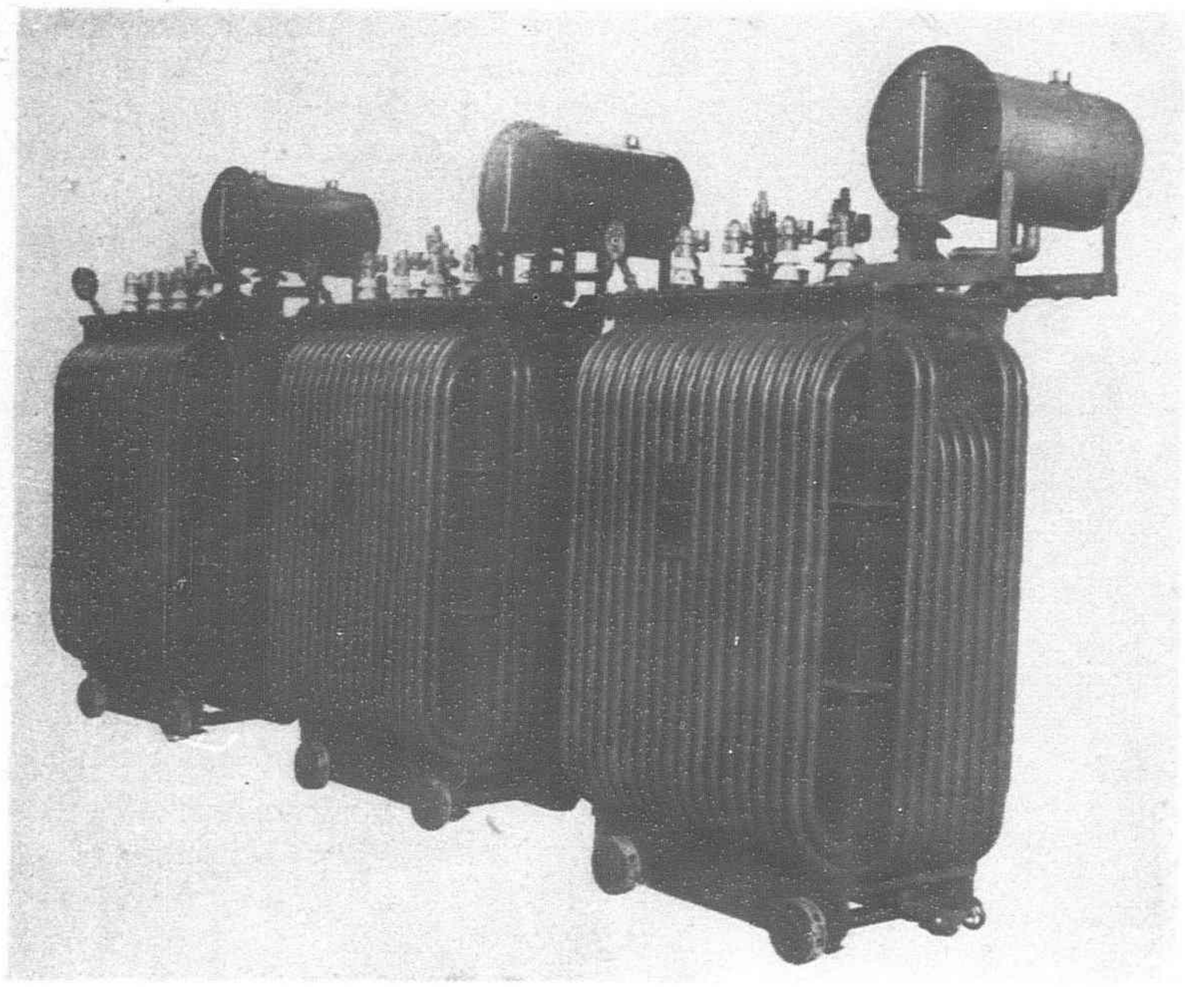


Fig. 5.—Bank of 500 kva transformers

They range from a few hundred to several kilowatts in size. The vacuum tubes (valves) are, of course, imported, but nowadays, even the measuring instruments are manufactured locally to very close limits of accuracy. There is one firm here in Shanghai making all types of electrical measuring instruments with very creditable results. Including the making of electric clocks, this concern does an annual turnover of over a quarter million dollars business, but mostly on instruments.

Fig. 12 shows a 5 kw. set at Hankow, which is being enlarged to 10 kw.

As vacuum tubes (valves) appear to be the only article that must be imported, it is understood that a commission has been sent to England by the National Government to study this problem with a view to establishing a plant in this country for manufacturing them.

Domestic Appliances, Etc.

The major activity in this industry is the electric lamp bulb business. There are many factories but the great majority of them are of small size, unstable and produce very poor quality lamps. Eliminating such plants, there are only about three to four concerns manufacturing lamp bulbs and equipped with proper machines and apparatus for testing. Here again, the greatest difficulty appears to be the obtaining of the necessary raw materials, and one is inclined to assert that only the labor is furnished by Chinese hands. The imported material list such as sand for glass, rare gases for gas-filled lamps, chemicals which are treated as military contraband, filament wire, mandrel wire, supporting wire, special glass-junction wire of the same coefficient of expansion as glass and copper leading wire, etc. However, in spite of this formidable list of materials that has to be imported, the trade seems to prosper and the factories are kept active.

The next most active line to lamp bulbs appear to be flash-lights. There are about fifty plants and small shops busily engaged, working day and night. This is brought about by the convenience of the flash-light in the interior where the cities are usually poorly lighted. And again, nearly every Chinese soldier now carries a flash-light. Even in the more remote provinces of the west and north-west, flash-lights and dry cells have become a daily necessity, in place of the age-old red candlestick. It has been most difficult to collect accurate data regarding output of these plants, because some have no such record and most of them are very secretive about giving any information. However, as a conservative estimate, the daily output of all the plants is around 500 cases, each case containing 1,440 pieces of flash-light cells.

The making of lampholders, tumbler switches, plugs and sockets and other lighting fixtures was started many years ago but there appears no particular improvement as to quality. This is partly due to the use of poor raw material and a desperate effort to cheapen the product. In a survey made during the last few months, and among the machine shops, there have been seen only two fully automatic machines making small parts such as specially shaped screws, studs, pins, etc. Even the turret lathes are nearly all manually operated. A further hindrance is that machine tools are used which are entirely unsuited for the purpose, the works expecting a very ordinary lathe to do a great variety of special jobs. There is much to be done in the way of planning, tool room practice, adoption of jigs, better cutting tools and general machine shop layout. At present, most of the shops simply grow without any system of economical layout.

Other domestic appliances such as electric irons, toasters, radiators, fans, are very plentiful and reasonable in price. An electric fan can be had for $25.00 and a 3 kw. radiator for $16.00. Electric fans are made by several concerns and there is very strong competition. The annual output of all the factories is about 100,000 pieces, including both desk and ceiling types. There are also three plants making enamelled and galvanized electric conduit and fittings. The method of production is rather crude and slow, threads are badly cut and the wall of uneven thickness. The daily output of these three shops is from 8,000 to 10,000 feet depending upon the size. The retail price is approximately half of the imported British quality. And because of this, the demand is fairly brisk.

A great number of small and "backyard" manufacturing outfits exist, but they have been purposely omitted in this survey as they are extremely unstable, here to-day and gone to-morrow. These "tramps" present a real problem to the larger manufacturers since the latter has to stand higher manufacturing and establishment charges, while with the former, their sole intention is to make something that looks like the article without any attempt to re-

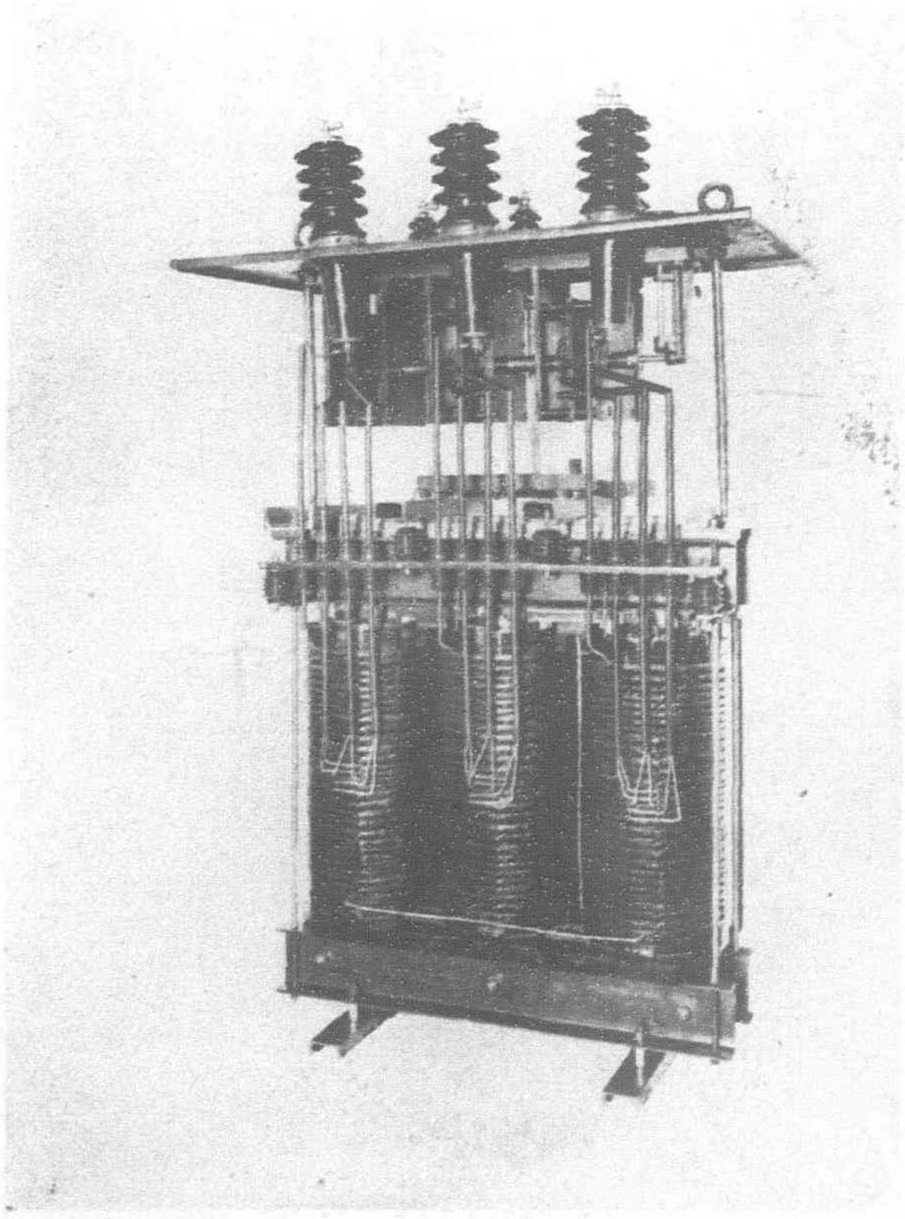


Fig. 6.—600 kva transformer, 30 kv primary 2,200-volt secondary

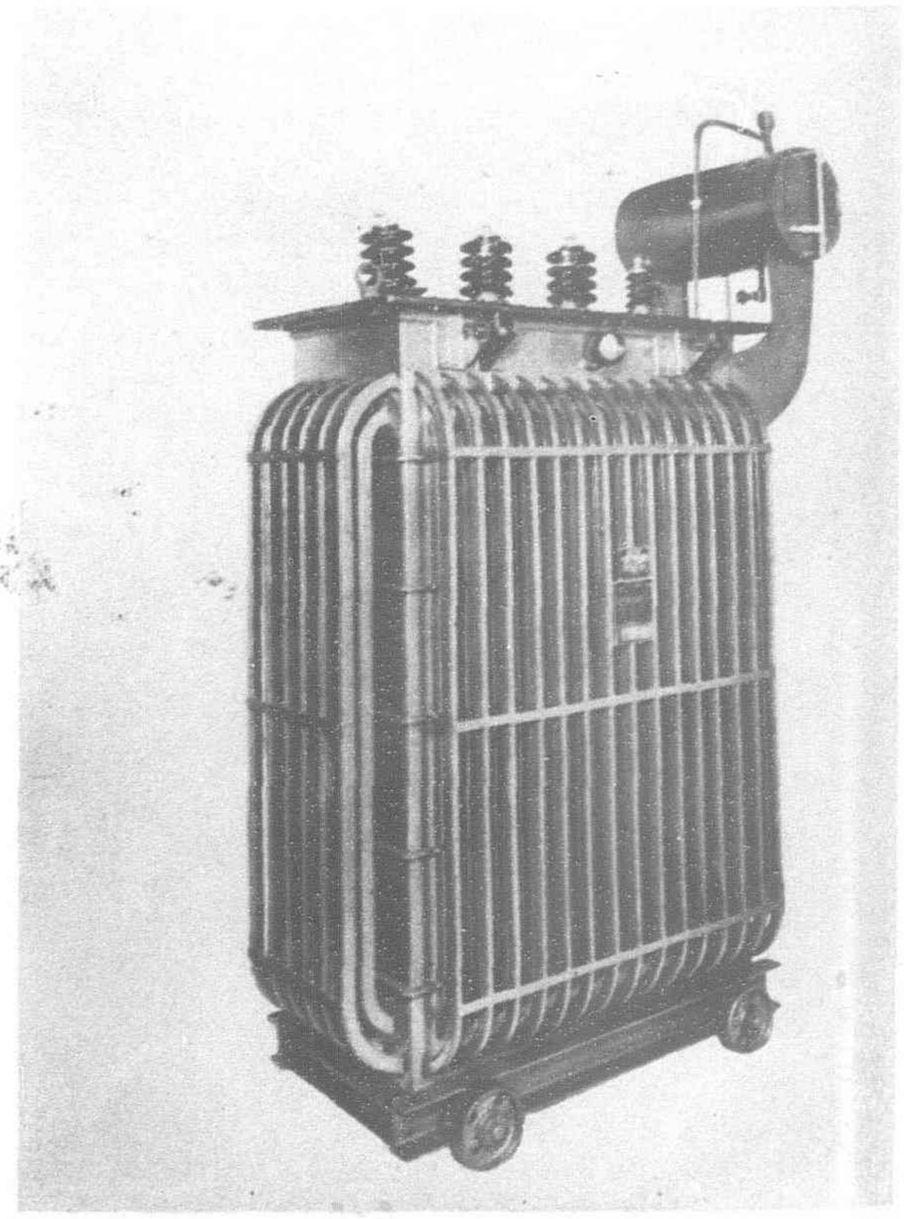


Fig. 7.—600 kva transformer, 30 kv primary

Fig. 9.—15 watt S.W. military portable transmitter and receiver

cognize quality. The worst offenders are the ones making electric lamp bulbs. There are several "backyards" collecting used bulbs, breaking the glass, utilizing the existing stem and cap, putting on a new filament and then reselling the reconditioned lamp as new. With the prevailing smuggling, the matter is made worse by the smuggling in of cut and already coiled filaments; a finished ordinary vacuum lamp selling for only ten cents.

In discussions with all the people interviewed, they are unanimous in complaining that parts imported for an article have to stand a much higher import duty than if the whole article is imported. For example, electrical measuring instruments enter at 10 per cent ad valorem but for their component parts, the following import duties are levied :—Copper wires 20 per cent, Jewels to receive pivots 30 per cent, Phosphor bronze springs 25 per cent.

Power switchgear can be imported at 10 per cent duty, but the local maker has to pay 25 per cent duty for insulating materials such as Tufnol and Bakelite, 20 per cent for copper rods and so on. However, since the object of the Customs is to collect revenue, it is hoped that the Government will not read this paper and increase the tariff on the whole article.

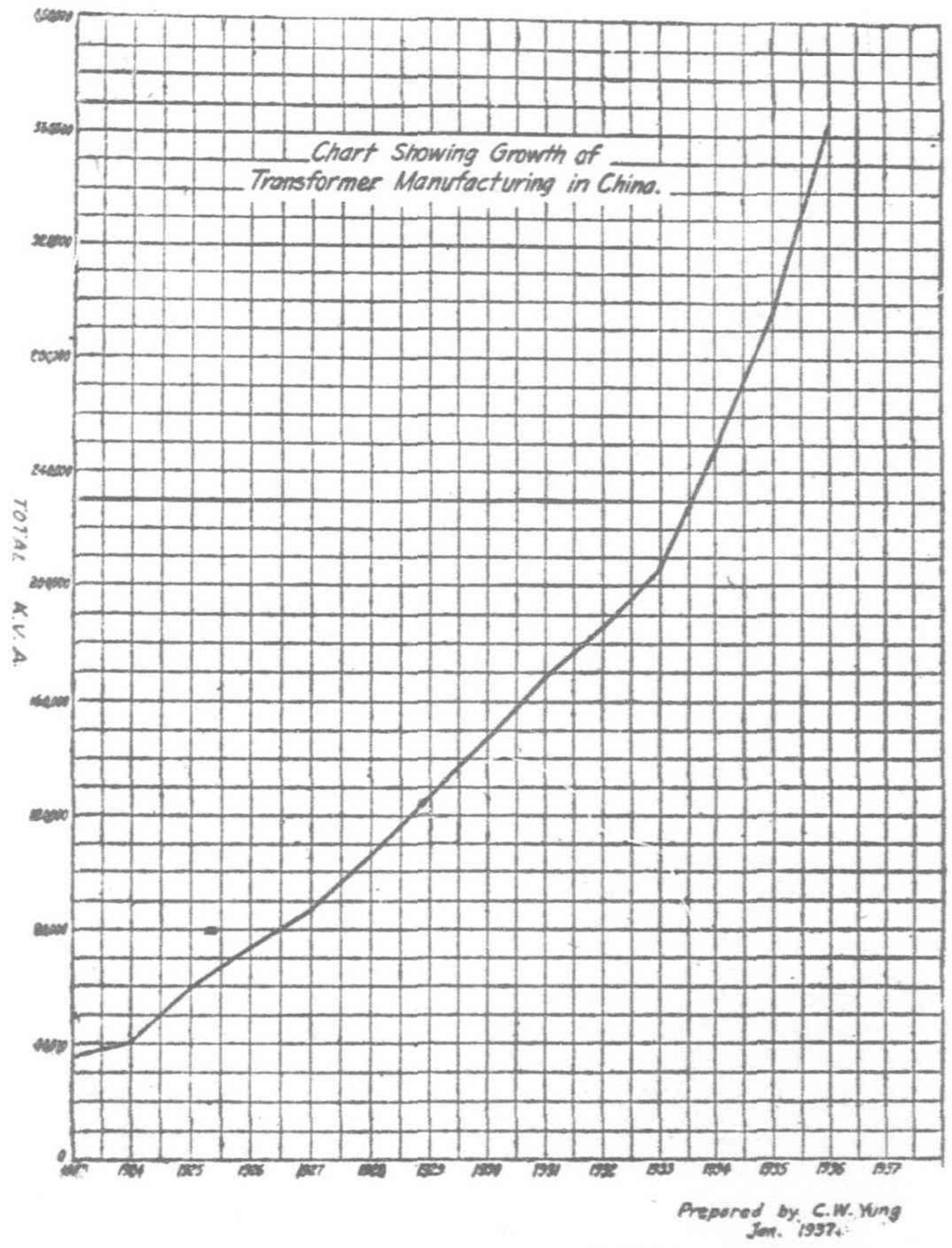


Fig. 8.—Chart showing growth transformer manufacturing in China. Prepared by the Author C. W. Yung

Equipment and Personnel

As already mentioned previously, the general conditions of the average machine shop leave much to be desired. With one or two exceptions, all the machine tools of a concern are crowded into one building which is usually badly lighted and ventilated. Nearly all the lathes, shapers, milling machines, planers, etc., are of German make, mostly of light construction and consequently cannot undertake work of great accuracy. Also, there is an absence of tool rooms and the comparatively under-paid mechanics cannot very well afford to provide themselves with decent tools. And with the management, it is a case of getting along as best one can, nursing the idea that expensive tools will be either lost, stolen or damaged. Therefore, while it is a pride for workmen in America or Europe to possess decent tools, their fellow workers in this country have to go without them. In spite of this feature of poor equipment generally with each concern and particularly with each workman, good workmanship is still produced, and there is no doubt, that with improved equipment, still better articles can be produced.

Still another feature which calls for betterment is the necessity of adequate inspection. Generally speaking, the idea of inspection and elimination of defective goods appears to the management as wasteful since it cuts down production. However, this necessity is now gradually becoming recognized as competition becomes daily keener and importance of quality stressed. There is one lamp bulb factory, recently visited, showing rather strict inspection throughout the whole process of manufacturing. The daily output is placed around 6,500 pieces of lamps, but deleting the defective ones, the figure is reduced to only about 5,000 bulbs.

Coming to the personnel of this industry, one finds that there has been great improvement from the days when the number one foreman used to hold sway. His place is now taken by keen, alert and young qualified engineers, all very anxious to do their best. The owners have come to realize that these young engineers are well worth their investment. One feels, in their presence, an air of honesty and straight dealing which was absent in the days of the "Number One" fitter control era.

As for the workmen, efforts are being made to give them and their sons and daughters an education to uplift them to a higher intellectual level. There is one concern making wireless equipment that actually houses, feeds and trains apprentices in its shops. The average Chinese workman, while docile and good natured to handle, has the singular defect of not being

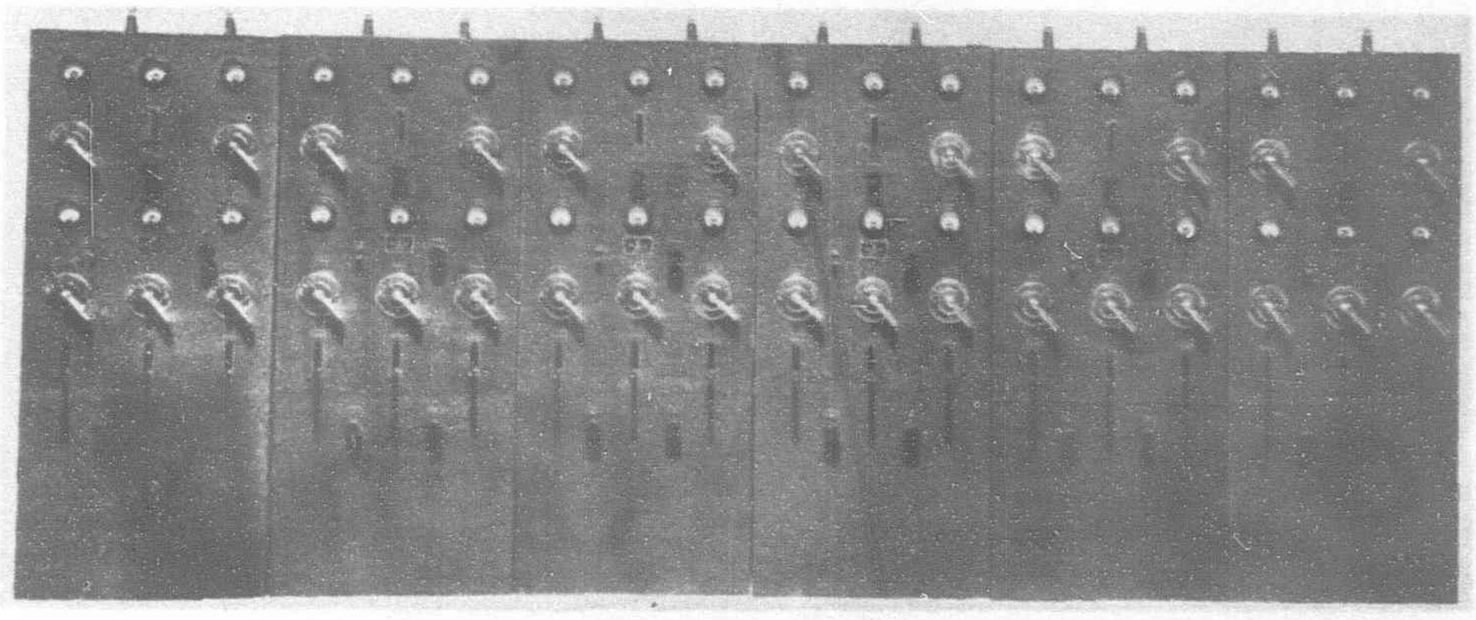


Fig. 10.—Six sets of 400 watt S.W. transmitters

accustomed to disciplinary treatment. That is, he is prone to do his work according to his own imagination instead of carrying out an order to the letter. To illustrate, if a workman is told to operate a die on a punching press up to a certain definite quantity when it has to be reconditioned, he will continue operating regardless of this instruction. Such cases occur actually very often. However, it is hoped that with proper training as well as better treatment, they will adapt themselves capably.

Summary of Factories

The following list gives a brief idea of the various activities connected with the manufacturing of electrical equipment in this country :—

Kind of Industry	*No. of Establishments*	*Approx. No. of Workers*
Transformers	3	400
Motors	4	350
Switchgear, industrial	4	250
Fans	10	500
Switches, plugs, sockets and general accessories	10	220
Radiators, irons, toasters, etc.	6	300
Glass and reflectors	5	100
Lamp bulbs	14	300
Flash-light, dry cells and small lamp bulbs for flash-light	51	2,000
Electric conduit	3	100
Insulators and other electric porcelain products	3	200
Neon signs and neon sign transformers	11	150
Static condensers	1	20
Wireless parts	5	200
Wireless transmitters	4	200
Electrolytic copper refining	1	10

Besides those listed above, one finds all copper and brass-smith shops making electric light brackets and fixtures. These are too numerous to mention. In the above list the number of workmen employed conveys a good idea of the size of the works.

It will be noted that reference has been omitted concerning the several large foreign establishments manufacturing electrical equipment, such as the lamp works connected with the International General Electric Co., which can easily turn out a monthly output of a million lamps; the motor works of the General Electric Co. of London and the Eveready Battery Works. It is a most significant fact, that these concerns have already established their plants here to take care of the growing demand for electrical equipment which the rapid development in this country calls for. Therefore, one can confidently predict that in the next five to ten years to come, the importation of such electrical equipment as motors, switches, insulators, transformers and domestic appliances will drop considerably, if not cease altogether. Already, at present, there are no finished lamp bulbs for ordinary use imported and imported fans have dwindled greatly in sales.

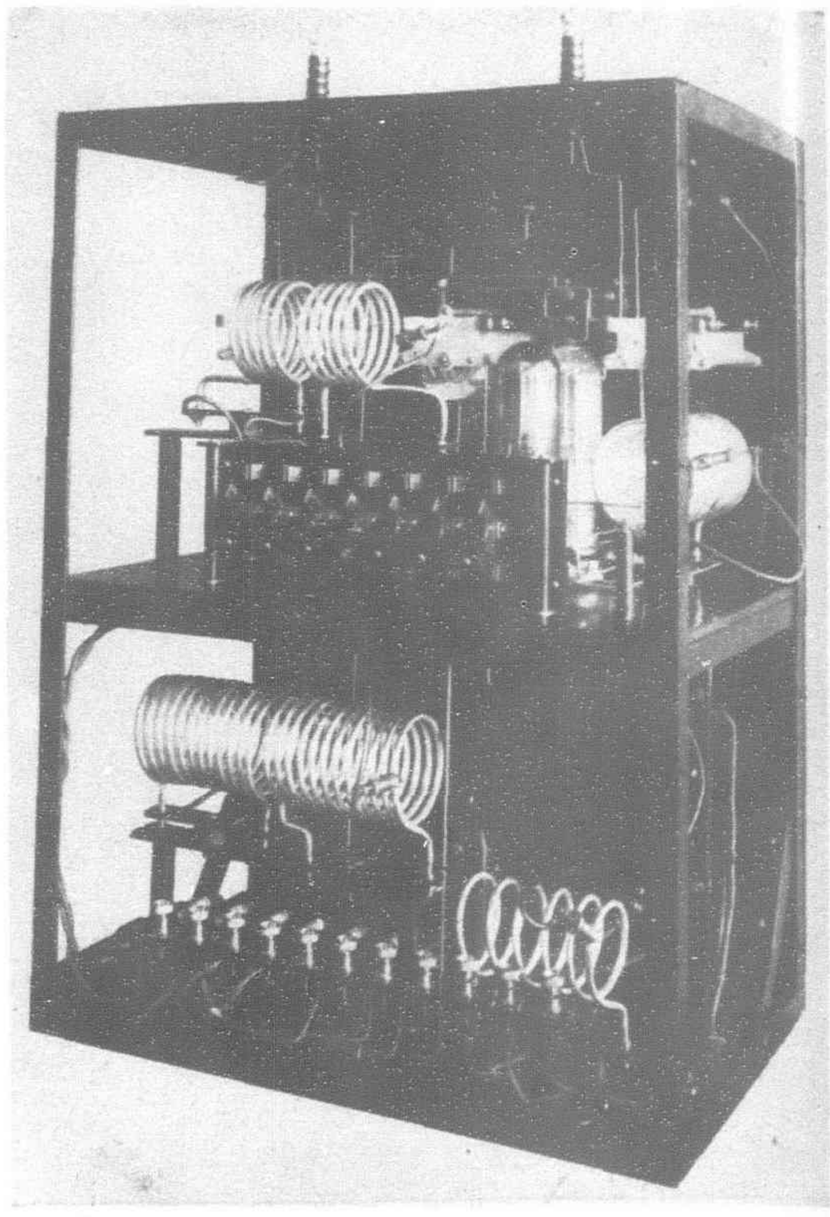


Fig. 11.—150 watt long-wave ship's transmitter

In view of the foregoing conditions, there are several foreign concerns already planning to establish plants in China in the near future. This will help to further develop the country and also provide jobs for many of our countrymen. Socially and economically, we shall witness a great change for the better.

In conclusion, it will be agreed by all of you that the potential possibilities are vast. The field is so great and work for everybody ahead. Already, the transmission network in the lower Yangtze valley is spreading from Nanking to Shanghai and Hangchow. Many small and uneconomical generating plants are being cut out and lower tariff of electricity is being made available to the wide country-side. Further linking up of the larger power stations will assure still greater reliability of service and also decrease generating cost. When better service and reduced cost of current are offered to the public, it follows that more equipment will be required and that this industry will be destined to grow to such size and importance as we see in other parts of the world.

A word of thanks must be recorded here to all those firms and persons who have generously given their time to provide information, data and also photographs. The author is greatly indebted for their assistance.

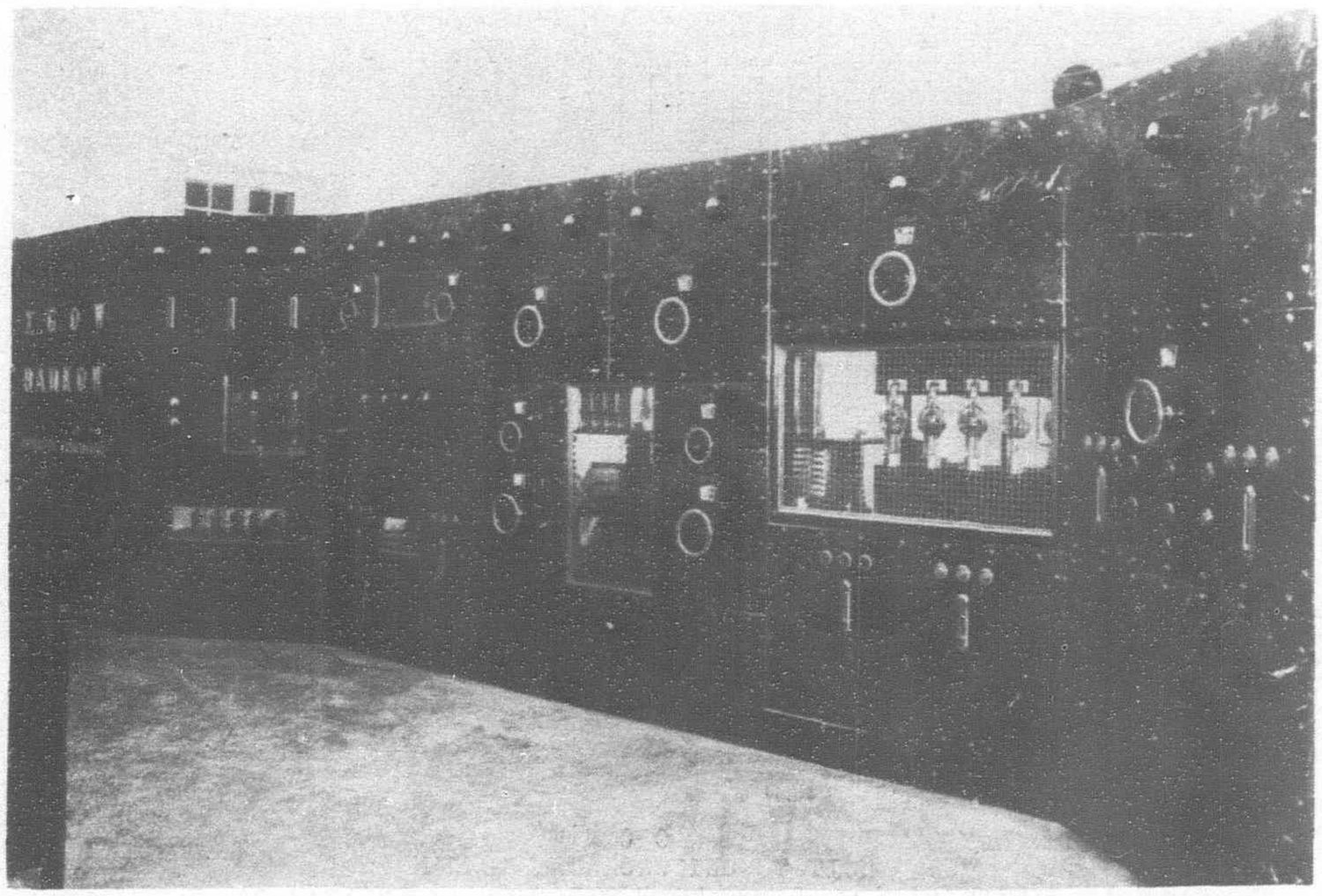


Fig. 12.—Five kw. transmitting set at Hankow

JAPAN'S RADIO—TELEPHONE PLANS

Direct radio telephone communication with 45 of the world's most important cities and countries is planned by the Japanese Communications Ministry before 1940. A sum of Y.3,000,000 will be spent and at least two of the present transmitting stations will be scrapped, and several new ones built. The two transmission centers are to be Tokyo and Osaka. The four-year plan includes remodelling of the nine transmitting and receiving stations. As the present system of communicating with Europe by way of Nagoya is inconvenient, the Tokai station will be abolished. The stroke is a bold one, as the station was erected at considerable expense only recently. In the future, the Tokyo communication bureau will handle all connections with Europe and America. Calls for points in the Far East will be handled by Osaka. The receiving station at Yokkaichi, Mie Prefecture, is to be abolished. Y.1,290,000 is being expended by the Ministry to speed construction of Ono receiving station. It is to be completed before the end of 1937.

Gas Manufacturing in the Far East

British Plants for Japanese Gas Works

By WALTER T. DUNN, M.I.Mech.E.

In previous articles the writer has described the plant and machinery of various gas works which he visited during hiz tour in the Far East. These included the Municipal Gas Works of Singapore, the Works of the Shanghai Gas Company, and the Works of the Tokio Gas Company.

The activity of British gas plant manufacturers in supplying important units overseas was remarked upon. This alacrity was noticeable in every town which the writer visited, and the names of the enterprising firms who had thus distinguished themselves were given.

In the present article tribute is paid to the well-known combined firm of The Power Gas Corporation and Messrs. Ashmore, Benson, Pease & Co., of Stockton-on-Tees, on account of the part they are taking in the introduction of British-manufactured plant into the countries of the Far East.

Water-Gas Retarb Generator Plant of Yokohama Gas Works

Probably the most interesting installation is that comprising the extensions of the bituminous water-gas retort generator plant at the Yokohama Gas Works in Japan, the first section of which was brought into operation in the year 1925.

The plant at the time of its installation was a new type which had been developed by the contractors to provide in one plant the features of cheapened first-cost; quick response to peak-load requirements; flexibility in capacity; and low-production costs previously sought after in combinations of retorting plant and complete gasification plant.

In the operation of the plant the coal is treated under conditions producing large quantities of low-temperature tar and a high yield of ammonia with a constant-quality gas of a higher calorific value than that from ordinary water-gas or complete-gasification plants; while the plant can be worked as a complete gasification plant or as a coke-producing plant as may be desired according to the state of the coke market at the time.

The fuel employed is a mixture of Japanese coals of high volatile content (about 45 per cent). Under incomplete gasification conditions the gas yield usually averages about 900 to 950 cubic meters per ton of coal gasified, having a calorific value of 3,000 to 3,100 calories per cubic meter. Actually a higher calorific value of gas could be obtained, but as the declared gas value at Yokohama is 3,000 calories per cubic meter, the gas is diluted with blow-gas to bring the value down approximately to this figure.

The first installation comprised two generator units, each of 500,000c ubic feet per 24 hours capacity, with mechanical coal-feed and mechanical coke-extractor, a dust washer, an ammonia absorber, a recuperator, a waste-heat boiler, two exhausters, two blowers, control gear, circulating pumps and piping, gas and air mains, etc.

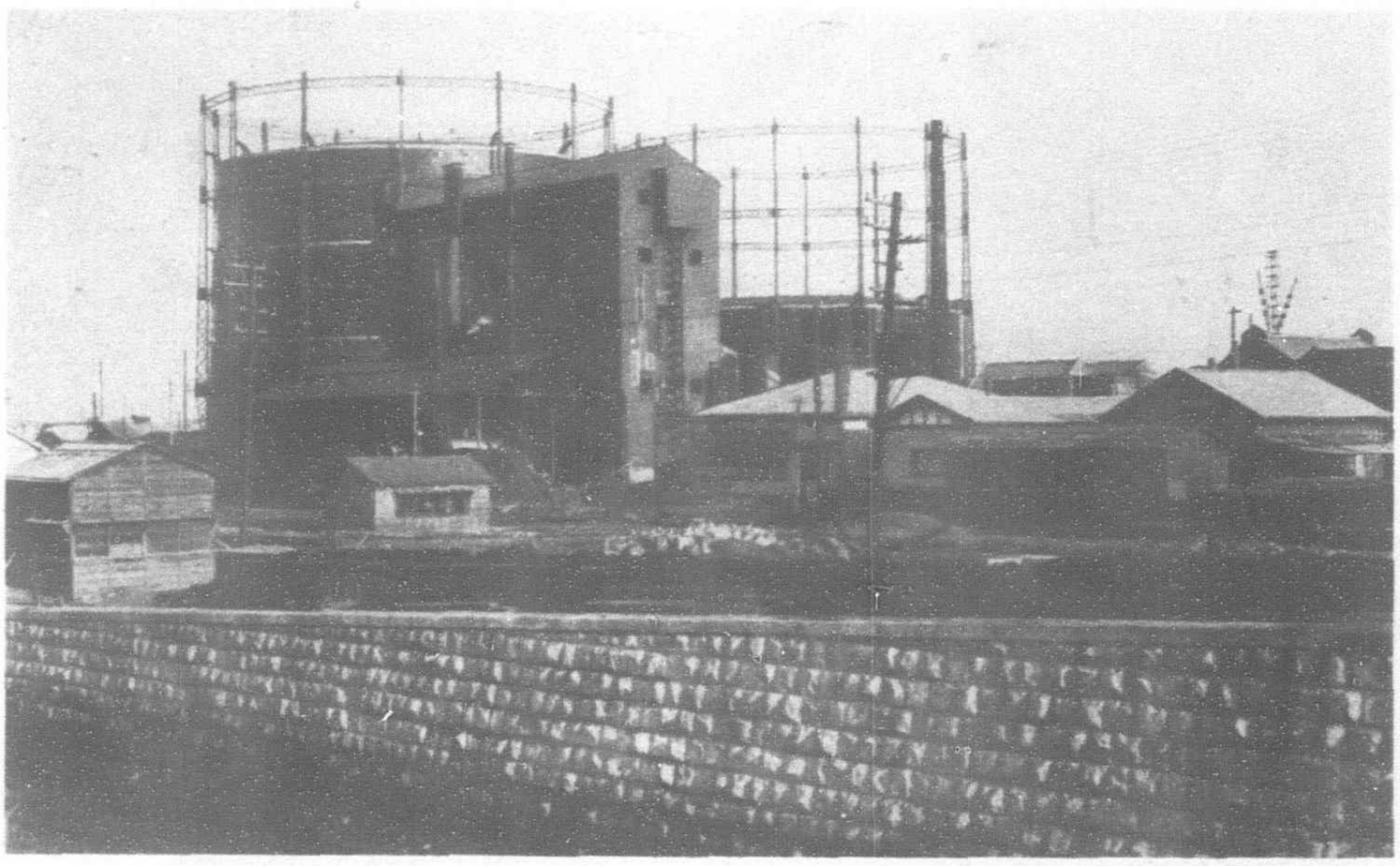


Fig. 1.—Generator House of the Yokohama Gas Works, with waste-heat boiler in the foreground

The mains, exhausters, and blowers were designed for a total capacity of three million cubic feet per twenty-four hours. The first extension comprised a further two generators, dust washer, recuperator-superheater, waste-heat boiler with the requisite connections, etc. The second extension consisted of one generator unit, a dust washer, a recuperator-superheater and a waste-heat boiler and connections. Two further generator units were subsequently added, so that the whole plant thus extended now provides almost all the gas required for the port of Yokohama.

Reference to Figs. 1 to 4 will enable the general lay-out and construction of the plant to be understood.

Fig. 1 is from a photograph of the generator house. The waste-heat boilers will be noticed in the foreground. Fig. 2 gives a view of the operating platform and shows the generator tops and the mechanical coal-feed gear. Fig. 3 shows the mechanical coke-extractor on the generator base. The recuperator base is also seen. A diagramatic representation of the plant is given in Fig. 4.

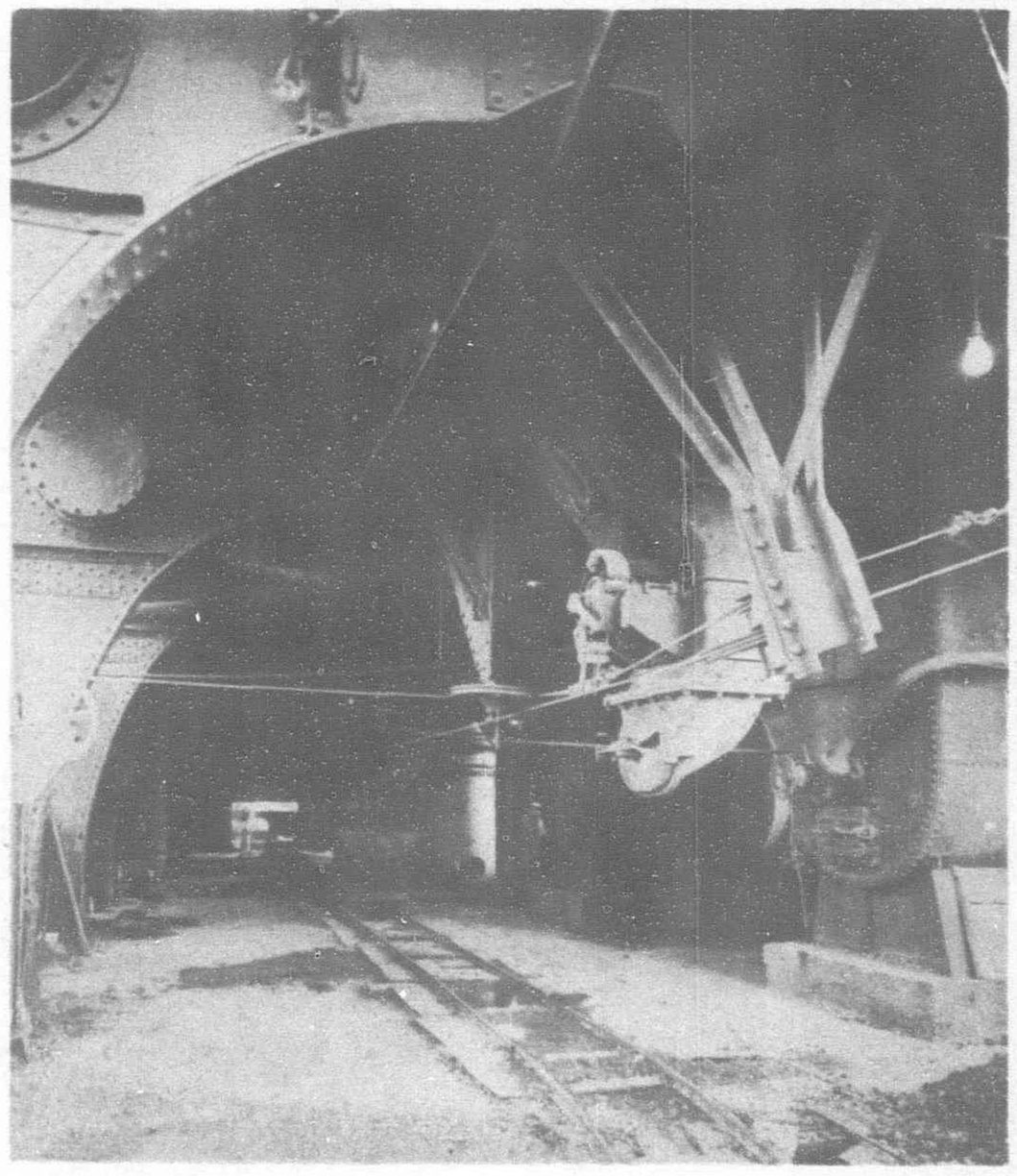


Fig. 3.—Mechanical coke-extractor on the generator base

Other Gas-Plant Installations

It may be added that other installations or equipment supplied by the firm referred to include the following:—

For the Toho Gas Company at their Nagoya works: a two-unit blue water-gas plant of one million

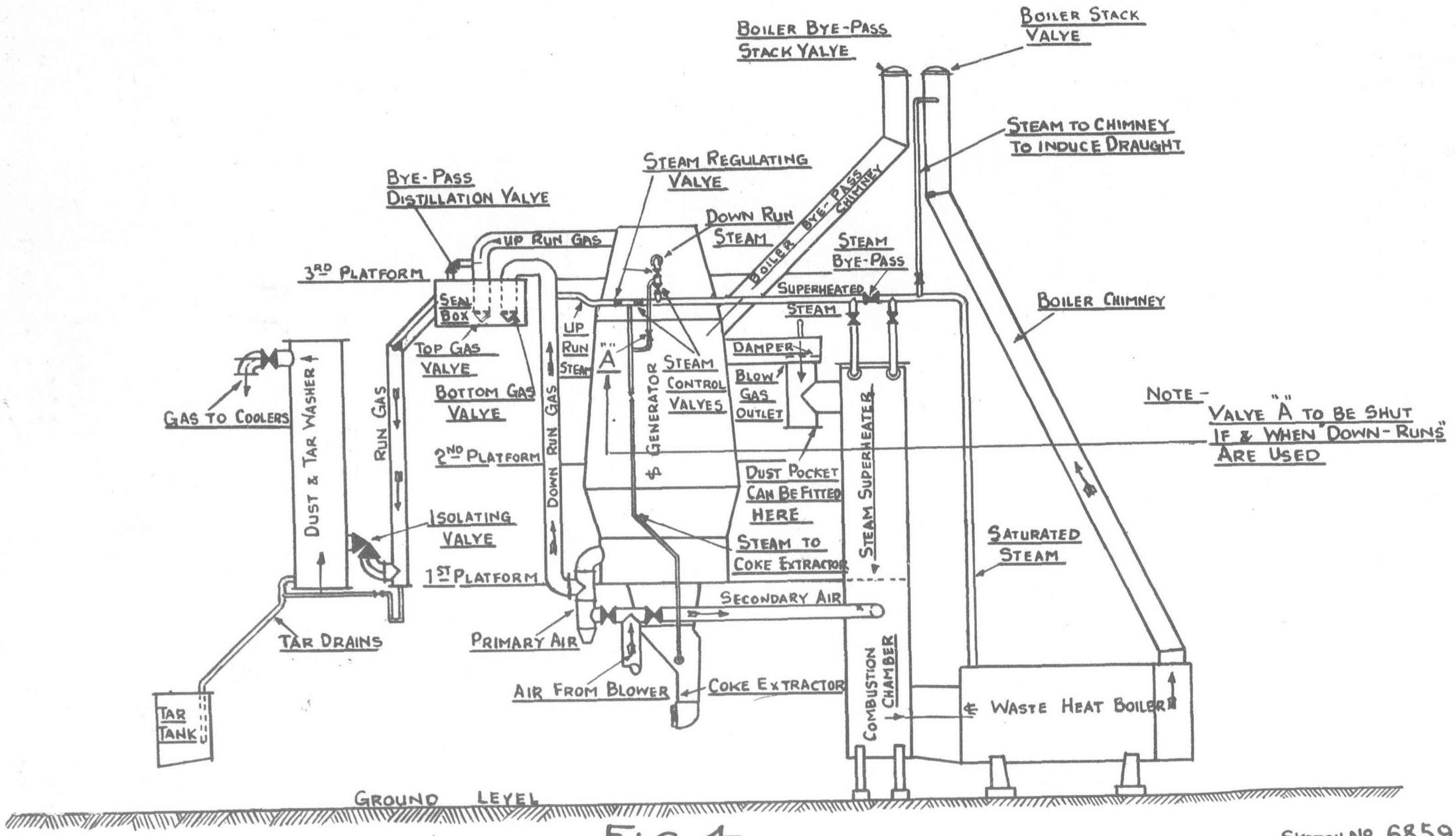


FIG. 4.

—YOKOHAMA GAS PLANT EXTENSION DIAGRAM—

SKETCH Nº 6859
DATE 15/4/26

Fig. 4.—Diagrammatic representation of the plant

cubic feet capacity per 24 hours. This plant comprises two static generators ; two Lymn-type washers ; two blowers ; a recuperator ; a waste-heat boiler, and the usual connections, valves, etc.

For the Private Gas Works of Tokyo Denki (Tokyo Electric Lamp Company) : a two-unit blue water-gas plant, each unit being of 150,000 cubic feet capacity, and comprising static generator with valves and connections, washer, control gear, blower and waste-heat boiler.

For the Tokyo Fukagawa Gas Works : ammonium sulphate plant consisting of Lymn-type washer absorber, vacuum evaporator with condenser and aspirator, electrically-driven bronze circulating pumps and condenser water pumps.

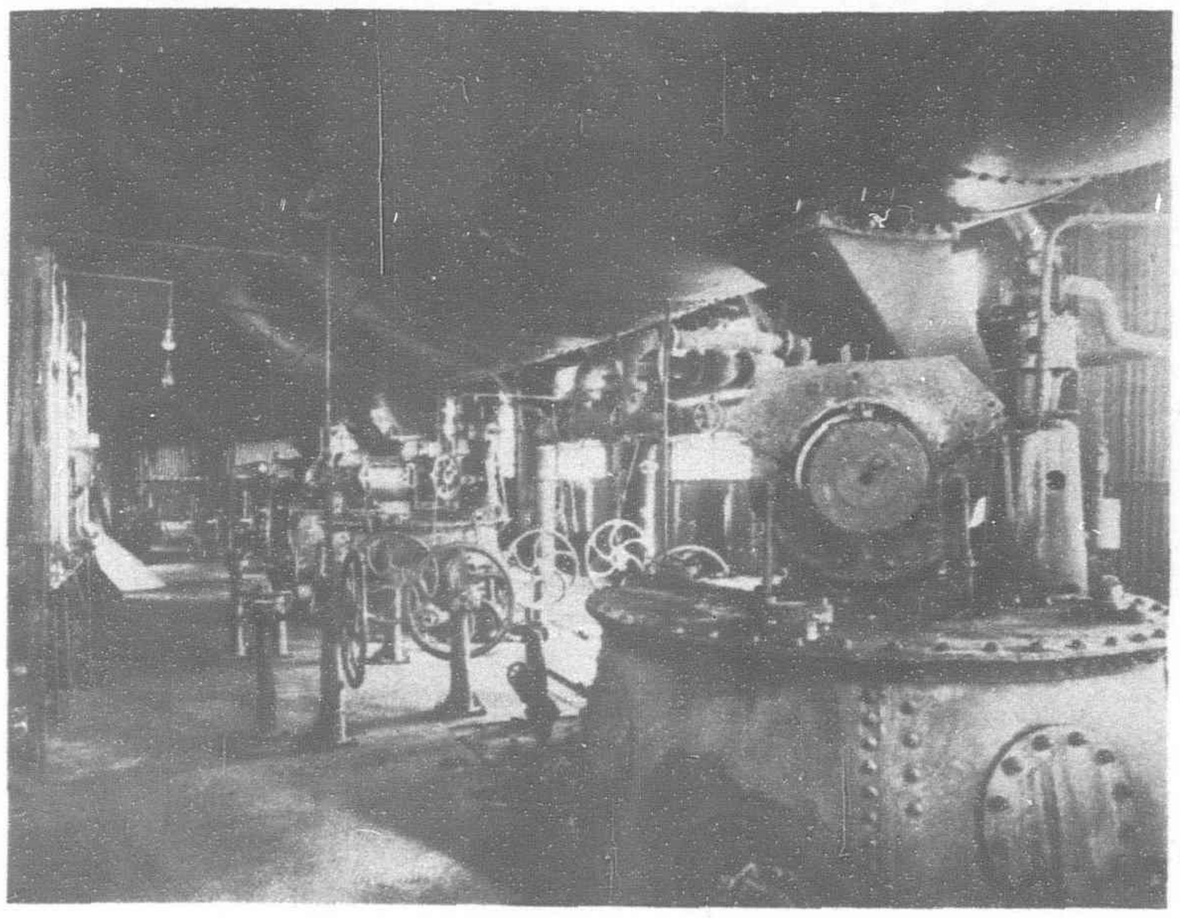


Fig. 2.—View of the operating platform with generator tops and mechanical coal-feed gear

For the Tokyo Gas Company : a four-lift column-guided three-million cubic feet gas holder with steel tank has been constructed and erected.

The firm has also supplied for the *Chiyoda Gas Company* a four-lift column-guided three million cubic feet capacity gas-holder with steel tank ; and *for the Yokohama Gas Company* four 20-ft. by 16-ft. by 5-ft. 6-in. purifiers with valves and connections.

It is likewise interesting to observe that outside the town-gas industry the Power Gas Corporation, and Messrs. Ashmore, Benson, Pease and Company have supplied to Japan for general industrial and chemical process work large units of mechanically-operated automatically-controlled blue water-gas plant, mechanical gas producers, gas-cleaning plant and gas-treatment plant, including catalytic oxidation plant, absorption plant and chemical purification plant.

Radio 'Phone—China and Abroad

In the near future it will be possible to pick up a telephone receiver anywhere in Shanghai and in a few minutes be talking with friends in London or New York. Tests are now being completed to prepare the way for daily commercial communication with Britain and America by radio telephone and it is expected that at least one of the two circuits will soon be operating.

The new service will be made possible through a hook-up with the Chinese Government Radio Administration system. The opening of the American circuit will follow the completion of negotiations now in progress between the Ministry of Communications and the American Telephone and Telegraph Company. It will be possible to call any point in the Bell system via the Pacific Ocean. Communication with London will be on a direct circuit across Asia and continental Europe.

Another important wireless-telephone service was established at the beginning of February, connecting Shanghai with Hongkong via Canton.

Rainbows in the Far East

(Continued from page 89)

and should not demand, as a return for assistance given, a downward readjustment of the Chinese tariff on Japanese goods.

Sharp Criticisms in Japanese Papers

The attitude of many leading Japanese newspapers with regard to accomplishments of the Mission to China is critical and betrays a sense of disappointment, forgetting, evidently, the assertion of Foreign Minister Sato that " it is exceptionally difficult to hit upon a capital plan in a day or a night." In the face of these criticisms at home Mr. Kenji Kodama on the eve of his departure from Shanghai expressed satisfaction over what had been achieved by the mission he headed, and said that he was pleased with the "free and frank " exchange of views which the Mission had had with Chinese officials and business men. In a formal statement he listed concrete results achieved by the Mission in the course of its visit to China, as follows :

First—Establishment of Investigation Sections in the Sino-Japanese Trade Associations in China and in Japan to study ways and means of promoting commerce between the two nations.

Second—Maintenance of a close liaison between the financial interests of China and Japan.

Third—Increased production of raw cotton and improvement of its quality, and formation of a Sino-Japanese Textile Industrialists' body to promote common interests.

Fourth—Formation of special committees in China and Japan to deal with various branches of industry to advance common interests.

In a situation as complex as that which confronts the statesmen of Tokyo and Nanking, it is not to be hoped that any method of procedure can be evolved effective enough to silence criticisms in the two countries. The shadow of Russia is a factor in this situation that neither Japan nor China can dare for an instant to disregard.

Russia and the Comintern

If anything of a superfluous nature is to be found in the recent utterances of the Japanese Foreign Minister, it is the suggestion that he threw out that the Soviet Government should denounce the Comintern or expel it from the country. It would be as reasonable to look for such an upset of underlying Soviet purpose as to expect the Soviet Government to dissolve itself and invite J. Pierpont Morgan to assume the post of Dictator over all the Russias. And, again, through its Foreign Minister the Tokyo Government has seen fit to decline the Russian proposal for a treaty of non-agression, which would remove all restraints in the Far East for future action by Moscow. The nature of the menace to China from Russia is to be found, after a decade of destructive warfare within the country against forces of Communism, in the hundreds of thousands of Chinese graves on the plains of central and south central China. Although gossip is heard at this time of an understanding, said to have been reached between Moscow and Nanking, it is quite possibly true that Russia and Russian aspirations furnish a cogent reason for the change that has taken place in the relations of Japan and China.

It may not be doubted that a real change, a change for the better, has taken place. Despite all criticisms, in China and in Japan, concrete achievements are to be set down in the history of the month of March. The Japanese Foreign Minister has offered the olive branch, and the leading men of both Japan and China have sat down and talked with each other in amity and good understanding. On a basis of simple equality the Tokyo Government seeks to deal with China, and the wealth and constructive genius that has built Dai Nippon into a great world power are enlisted in the furtherance of these aims. China is cautiously hopeful, but definitely receptive, and the clouds in the Far East are lifting, but over the border in the North Ivan goes on sharpening his sickle.

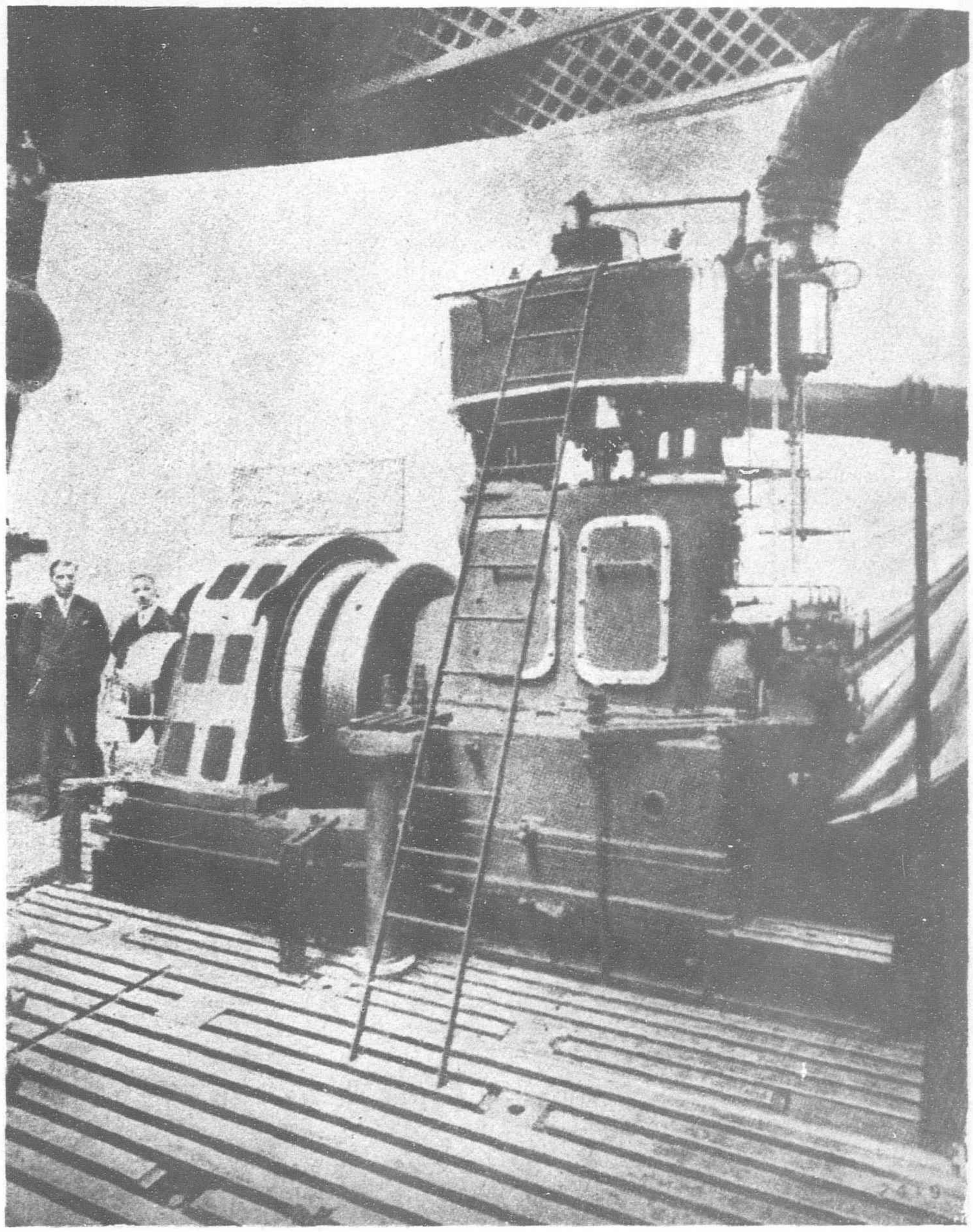
British Equipment Ordered for Power Plant in Canton*

THE Chinese Government Purchasing Commission have recently placed an order in England for a power plant to be installed at the Railway Wharf, Wongsha, Canton, and the main equipment comprises two "Babcock & Wilcox" water tube boilers, operating at 150 lb. pressure with superheaters, mechanical stokers, feed water economizers, and other accessories, also two "Belliss & Morcom" high speed engines of 320 h.p. running at 428 revolutions per minute, each direct coupled to a "Laurance, Scott" salient pole alternator, each of 220 kw. 0.8 power factor, 3,300-volts, three phase, 50-cycles.

These latter represent the latest scientific principles of alternator design, embodying the "Scott-Mossay" patent system of fabrciated steel frame construction developed by Laurance, Scott & Electromotors, Ltd., Norwich, and included also in their "Emcol" totally enclosed motors with integral self-contained ventilating fans.

The steel frame alternators are supplied in standard sizes up to 1,250 kva. suitable for steam engine, Diesel engine, or geared steam turbine drive, through one massive bearing; or for belt or rope driving, in this case two or three bearings being provided. The main features include the steel frame construction, mica insulation, sleeve mounted exciters, and extra large bearings.

As regards the frame, this is constructed throughout of steel, having welded joints so designed as to prevent any possibility of distortion, representing a great advance on the ordinary cast-iron frame construction. For example a true stator bore and a uniform air gap is obtained since the frame never becomes deformed as already indicated, while the frame is both stronger and lighter.



"Laurance Scott" generator direct coupled to high speed steam engine, one of two sets of 220 kw. each, supplied for railway wharf, Wongsha, through the Chinese Government Purchasing Commission

The stator is made of stampings of special iron insulined, that is, painted with insulating paint to prevent eddy currents, and assembled under pressure, while the large diameter shaft is of high tensile steel, with solid forged half coupling for bolting to the driving unit and an extension at the opposite end to carry the exciter armature. Also the magnet wheel is of rolled or cast steel carried on a heavy web plate bolted to a forged flange on the alternator shaft, while the poles are of laminated iron or cast steel and the stator windings mica insulated. Except in high tension machines the slots are of the semi-closed type with the coils impregnated before insertion. For high tension conditions, however, mica tubes are used in open slots.

The large bearings are of the pedestal type, split on the horizontal center line, and self-lubricating with not less than two oil rings. Bedplates, provided as required, are either cast-iron or fabricated steel, while in all cases, unless otherwise specified, the rating is for a temperature rise not exceeding 40 deg. C. after six hours on full load at the specified power factor, while the overload and other conditions comply with British Engineering Standards Association Specification N. 169.

* *Eastern Engineering and Commerce.*

TOKYO'S MAMMOTH RESERVOIR

Preparations for the construction of the largest reservoir in the Orient, and the second largest in the world, are now in progress at the village of Ogochi, Tokyo Prefecture.

The *Chugai* reports that the project, located in the mountains near the Yamanashi Prefectural border, will supply drinking water to the city of Tokyo. Negotiations have started for the purchase of the reservoir site, and plans for a road, two-and-a-half miles long, from Hikawa to Ogochi, will be completed soon. Permission to undertake the project has been given by the Home Ministry. As the demand for water grows with the rapid increase in population, the immediate aim is to assure an adequate supply for a population of 6,500,000, which is anticipated within a few years. The program is to be built around the new Ogochi reservoir. Further plans are being made to care for a population up to 9,700,000. The plan has been divided into three parts, the last of which is to go into effect in 1953. At a total expense of Y.376,000,000, the bureau plans eventually to draw water from the Edo and Tone rivers, and Lake Kasumigaura. The completed facilities will be capable of supplying the capital with nearly 1,000,000,000 gallons of water a day, more than doubling the capacity of the present system. The equipment either in operation now or under construction has a total estimated capacity of about 400,000,000 gallons a day. The first phase of the new expansion program will call for tapping the Edo River, and is in reality merely an extension of the present system. Work on the second step calls for the use of the Tone River.

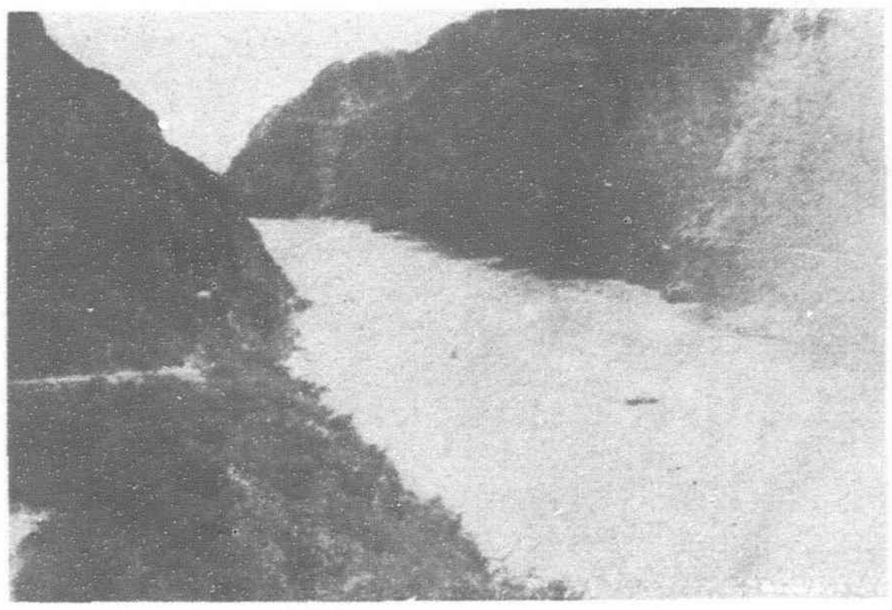
Yellow River Flood Control by Means of Detention Basins*

By S. ELIASSEN

In dealing with flood control of large rivers which are liable to overflow seriously their populated alluvial plains, it has generally been considered that an efficient and well-protected dyke system is the only adequate remedy, combined, where practicable, with spill-way channels to relieve the main, dyked river channel of a part of the flood flow when this becomes serious enough to threaten the integrity of the dyke system. However, even large rivers may differ so much in their hydraulic and physical characteristics, that it seems impossible to lay down hard and fast rules as to methods of flood control. It has been my privilege to have had occasion to look into the possibility of flood control by means of detention basins for the Yellow River, and although the studies have so far been of a preliminary and cursory character they have revealed that the method seems worthy of full study and experimentation mainly in order to find remedies for overcoming certain difficulties connected with the high silt content which the Yellow River carries during freshets.

In looking for sites for such flood detention basins for the Yellow River, one's thoughts first become centered on the main tributaries. However, as many of these tributaries are intermittent flowing streams during some years, or nearly intermittent flowing, there might not be flow enough to scour away the silt which would have become deposited during the flood season. The dams required would also have to be many, perhaps more than ten, in order to make sure that there would be effective control at all times. This would tend to make the method rather costly. Moreover, not all the tributary valleys are topographically such that detention basin sites can be found on them. These considerations led to making a search for dam and detention basin sites along the main river valley, preferably in the down-stream reaches in order to command control of as much of the drainage area as possible. During the late summer, 1935, I made an inspection trip along the main Yellow River valley from Meng Tsin Hsien to Shanchow in western Honan in order to find out if there were suitable dam and detention basin sites along this part, and as a result of this trip the following paper has been written. The hydraulic characteristics of the Yellow River have become fairly well known during the last 17 years and it has merely been a case of putting facts together, as far as we know them to date. They point to the conclusion that, provided the problems connected with the silt are possible of solution, the flashy floods of the Yellow River can be controlled to the extent of not exceeding 15,000 c.m.s. at the Peiping Hankow Railway Bridge, and that if more than one basin is to be utilized, (one in the Meng Tsin-Shanchow region and one on the main river valley in the Ho K'ou region) a reduction of the flood flow even to a maximum of 10,000 c.m.s. would seem possible. Such flow could be passed on to sea with a fair assurance that there would be no dyke breaches. Contrast this with the flow of 23,000 c.m.s. in 1933, or 18,000 in 1935, both notorious dyke break years.

In the following, only the effect of a dam and detention basin located in the Meng Tsin-Shanchow region will be gone into; but it goes without saying that if a second detention basin located in the Ho K'ou region is added, the control will be greatly increased, since everything indicates that a major flood is produced almost equally from the Wei Ho area and from the area which lies along the Yellow River upstream from Ho K'ou in the Shansi and Shensi Provinces. The flow coming from the very upstream regions does not exceed 3,000 c.m.s as it enters the mountainous course at the northern extremity of the Shansi and Shensi Provinces, while at Ho K'ou the flow can reach 15,000 c.m.s. A detention basin at Hu K'ou would also tend to prevent the synchronism of the Wei Ho and Yellow River floods, a thing which often happens.

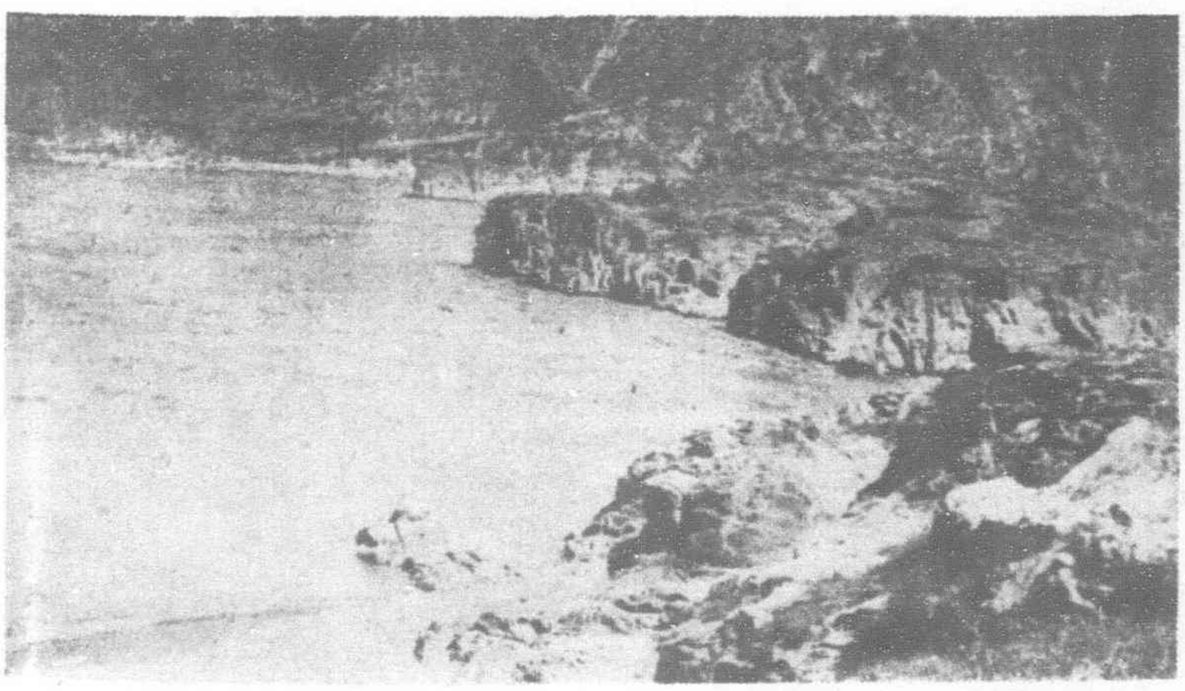


Pa Li Hu T'ung Gorge

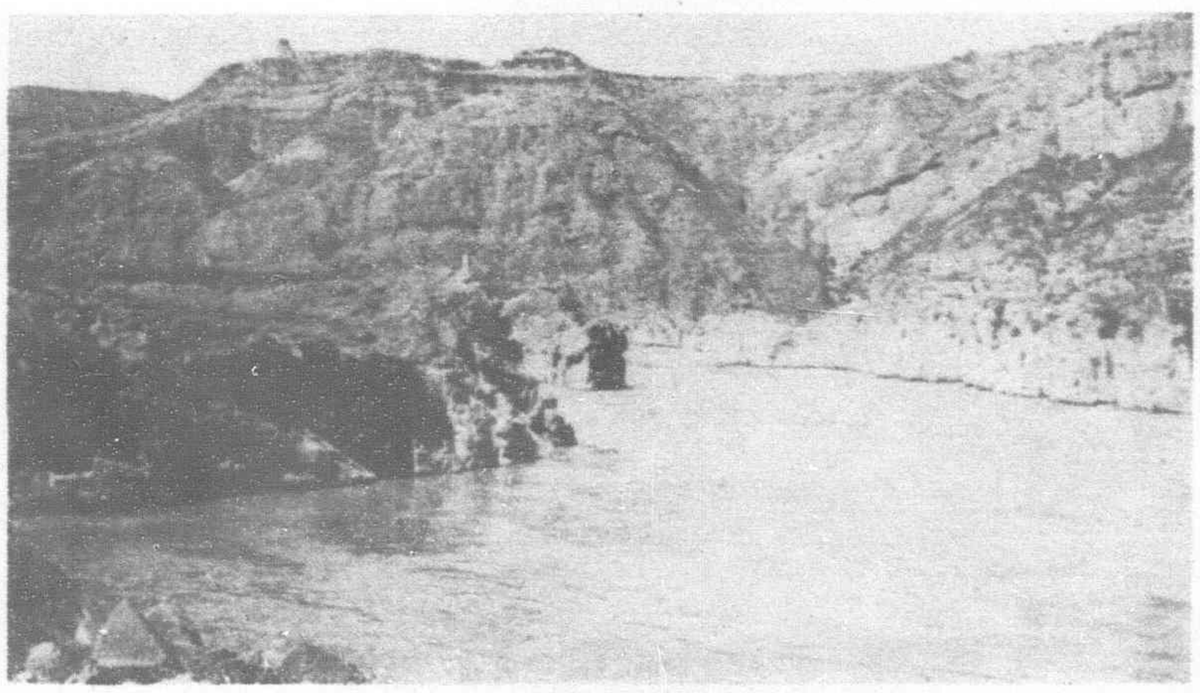
Physiographic and Geological Description of the Meng Tsin Shanchow Region

The Yellow River may be said to enter the coastal plain at Meng Tsin Hsien about 100 km. west of the Peiping Hankow Railway Bridge across the Yellow River. The valley is still quite wide at Mengtsin, but soon begins to narrow in rapidly, and from a point about 15 km. upstream from Meng Tsin the valley width averages from 500 m. to 300 m. at high water level. The average side slopes may be flatter than 1 : 2. In general the river winds between the rocky mountains in easy bends. Along the concaves the rocky sides directly flank the river, while the convex sides have projecting gravel spurs with terraced loess land behind, shallowly overlying the rock. In the straight reaches the rock is exposed right to the river edge on both sides. Villages lie about four to five km. apart, generally just above the extreme high water line. Usually they consist of 50 to 80 families. The main crops are those customary for North China such as millet, kaoliang and corn and undoubtedly wheat in the spring. There is no irrigation as the ground is too steep, and on the whole the agricultural condition can be classified as below standard according to normal North China farms.

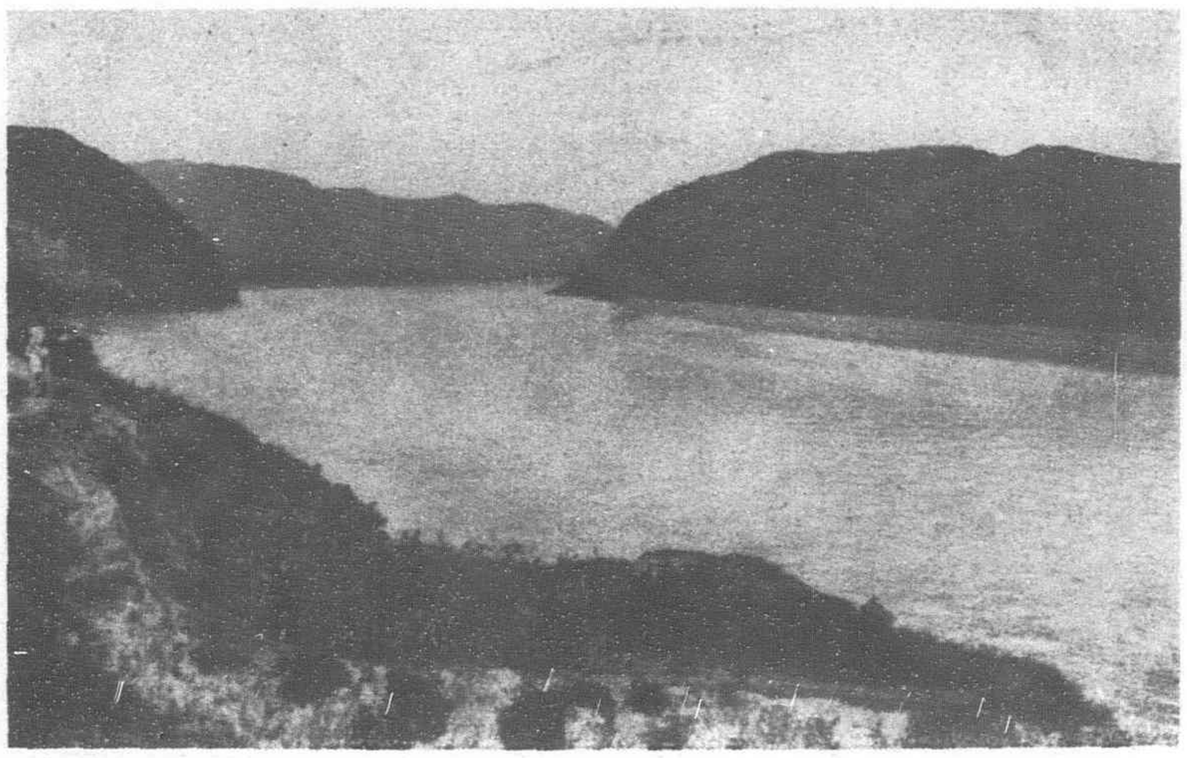
* *Journal of Association of Chinese and American Engineers.*



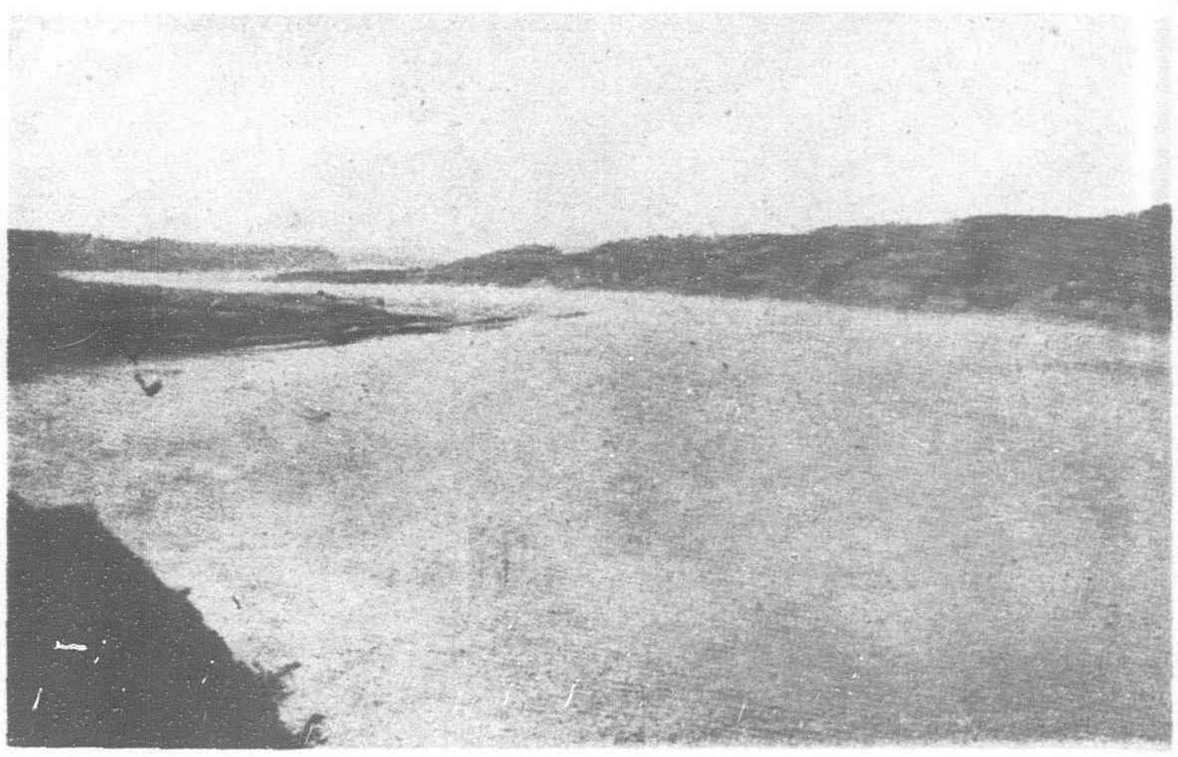
Upstream View of San Men Rapids



Downstream View of San Men Rapids



General View of Yellow River Valley upstream from Mengtsin Hsien



General View of Yellow River Valley upstream from San Men

From Meng Tsin to a village called Tung Wo, a distance of about 60 km. the rock formation is a strongly laminated schist or shale. Really this formation first begins at a place called Ching Tze Yen 15 km. upstream from Meng Tsin. The valley here does not seem to lend itself well for any dam structure. But at Tung Wo the formation suddenly changes to good lime stone and it is in this formation that one must search for suitable dam sites. One such place is at the lower end of a stretch which the natives call Pa Li Hu Tung, or " eight li hutung ", a typical gorge with a width of about 200 m. Although the laminations are horizontal the rock is otherwise good and may be suitable for a detention basin dam, not intended for impounding water permanently, where the matter of leakage would be unimportant. That dam stability could be safeguarded by proper construction methods seems possible. The high water period did not permit a close examination of the region and it is quite possible that other dam sites can be found which have a more favorable rock structure. The dam to be built would scarcely exceed 70 m. in height and this is only a moderately high dam considering present tendencies.

Another dam site which was examined was at San Men, the famous rapid 25 km. downstream from Shanchow. Here the rock formation is an exceedingly hard granite. At some point between Pa Li Hu Tung and San Men the formation must therefore change from lime stone to granitic. Immediately upstream from San Men it changes again to red sand stone and greyish slates. On the north bank the contact line of the two formations crosses the San Men dam site at an elevation of about 20 m. above the river level. Below, it is all solid granite. The storage for excess flood water upstream from this dam site is very good and the height of dam necessary here would probably not exceed 60 m. The width of the valley at San Men is not over 250 m. at high water level. The only drawback is that the site is rather far upstream. For this reason a site nearer Pa Li Hu Tung would be preferable. A further discussion of the two sites will be made.

The whole rock formation along the Yellow River between Meng Tsin and Shanchow is frequently very complicated. There may be fault lines crossing the river which ought to be located, especially those which are near possible dam sites. A thorough geological examination should be made of the entire valley between Meng Tsin and Shanchow before any dam site is determined upon. But there seems no question but that dam sites can be found along this part which would be eminently suitable for developing detention basins for flood control.

The capacity of the basins can be estimated approximately on the basis of a longitudinal slope of 1 : 1,000, an average bottom width of 500 m. and side slopes of 1 : 2. With a 70 m. high dam there would be a capacity of about 1,500,000,000 cu.m. of water. Actual surveys have not yet been completed, but it is hoped to have them finished this year. For the purpose of preliminary discussion, however, the above mentioned dimensions will suffice as they are not far from the actual conditions as estimated from a visit to the locality, and from known elevations of Meng Tsin and Shanchow.

Flood Control by Detention Basin Methods

Flood control by detention basin methods is not new. It has been used in Europe for several hundred years and lately also in America. It is very similar to the action of lakes in storing temporarily a part of the flood water which gradually becomes released after the worst part of the flood is over. Artificially the same action can be produced by building across river valleys, at convenient points, dams having relatively small openings at the base through which the flood water can pass more slowly than otherwise, while at the same time a part of the water is temporarily stored behind the dam, again to be released slowly as soon as the worst part of the flood has passed.

Such method of control, however, has so far been applied only to smaller rivers having drainage areas of not more than 10,000 sq. km. The method has been advocated strongly by certain engineers as a means for controlling floods on the Mississippi River in America ; but the opponents have always argued, and perhaps correctly, that the water masses during a severe flood were too great and that the number of storage basins required would be so many and costly that it was a highly uneconomical way of controlling the floods. It was also pointed out that there was no guaranty that the numerous dams would not function in a way opposite from what they were designed to do, as the controlled outflow from all of them would have more of a chance to coincide and thus merely aggravate matters. In general, American hydraulic engineers hold the view that a detention basin flood control plan is suitable only for small watersheds. However, if we analyze the Yellow River situation more closely it will be found that there are distinct possibilities as regards flood control by this method.

The Yellow River has a drainage area upstream of the Peiping Hankow Railway Bridge of about 750,000 sq. km. It cannot therefore be classed as a " small " river. Its maximum flood flow can at times reach as high as 25,000 c.m.s. That of the Mississippi River can reach about 80,000 c.m.s. and that of the Yang Tze Kiang near I Chang about 70,000 c.m.s. Compared with these two rivers the maximum flood flow of the Yellow River is about one-third less. Their drainage areas, however, are almost similar in size. In spite of the large watershed of the Yellow River the intensity of its flood flow is thus in reality not so serious. But it is when we come to compare the volume of water contained in a Yellow River flood with the flood volume of the other two rivers that the difference becomes much more marked.

The flood flow characteristic of the Yellow River is extremely flashy. Within 72 hours the flow can increase from 2,000 cu.m. per sec. to full flood height and back again to almost the same flow as when the flood started. The largest flood within the memory of living men, which occurred in August 1933, began to rise from 2,500 c.m.s. at noon on the 7th of August at Shanchow in western Honan. It reached its crest of 23,000 c.m.s. at midnight between the 9th and the 10th and was down to 6,000 c.m.s. by the early morning of the 13th. The whole flood wave thus occupied less than six days, and the really dangerous part of the wave, of more than 10,000 c.m.s. lasted 60 hours. The volume of flood water in this part was about 1,100,000,000 cu.m. of water.

If a comparison is made with the flood volumes of the Mississippi or the Yang Tze Kiang, (but comparing only the top parts of the floods which may be called dangerous), it will be found that these two rivers, due to their prolonged flood stages, have volumes in these dangerous parts which are from 40 to 50 times larger than those of the Yellow River. For their control they will require

storage capacities which are far larger than those required for the Yellow River. It is therefore mainly the characteristically short flood periods which make it possible to propose seriously the detention basin method for control of the Yellow River floods. In fact its flood flow characteristics lend themselves beautifully to such control. That the necessary storage space for the flood water can be found either on the main river itself or partly on some of the main tributaries is also fairly certain. Unfortunately the matter is complicated by the great amount of silt which the Yellow River usually carries during freshets and which most engineers fear will quickly make the storage basins useless. Handled correctly, however, this may not form an insurmountable obstacle. But the whole action will have to be verified by experimental processes.

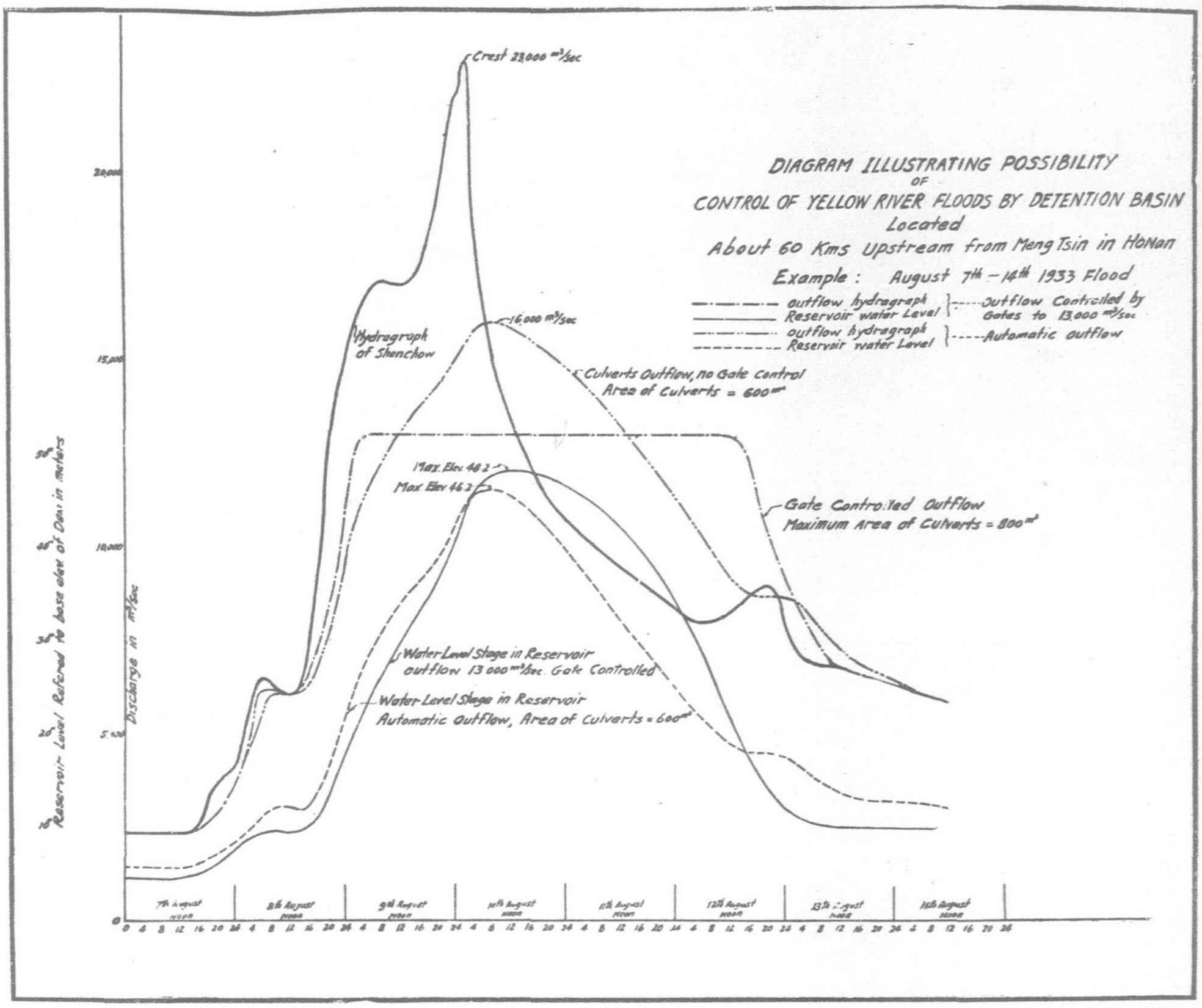


Diagram 1 a, showing different Stages during the Flood from August 7th—14th 1933

My feeling is, however, that the experiments will even show that it will be feasible to have a silt control as well as a flow control. If this is likely to be the case, the detention basin form of flood control would definitely place the Yellow River in a position where it could be regulated and made harmless.

Before going more fully into the detention basin action, a short discussion will be made of the capacity of the Yellow River channel through its dyked section in the plain.

Channel Capacity Through the Dyked Section

What the safe capacity of the channel through the dyked section should be is naturally a matter for consideration. We know, so far, that during the flood of 1933 there was no dyke breach upstream from Lonfeng in east Honan and that a discharge as high as 10,000 c.m.s. was conveyed without dyke breaches through the whole of the downstream section from T'ao Cheng P'u to sea (T'ao Cheng P'u lies at the crossing of the Grand Canal with the Yellow River.) This was the clarified outflow from the flooded areas in Honan, Hopei and Shantung. In 1935 probably 14,000 c.m.s. if not 15,000 c.m.s. was safely passed through the intermediate Honan and Hopei sections as far as to Lin Pu Chi just across the border of Shantung. Here, however, breaches occurred. It shows what can be done when the dykes are carefully watched and guarded. There may be a question regarding the remaining inner dyke section in Shantung from Lin P'u Chi to T'ao Cheng P'u ; but there can be no doubt that this section also can be strengthened so as to carry safely about 15,000 c.m.s. With a by-pass channel at T'ao Cheng P'u utilizing the T'u Hai Ho channel to carry say 3,000 c.m.s., and improving the T'ao Cheng P'u to sea main river channel section so that it can carry 12,000 c.m.s., it ought to be quite possible to have a detention basin controlled flood flow as high as 13,000 c.m.s. passing Meng Tsin reckoning on an addition of another 2,000 c.m.s. of simultaneous flood flow from tributaries between Meng Tsin and the Peiping Hankow Yellow River Railway Bridge. There would, however, be very rare occasions when the flood flow would reach 15,000 c.m.s. entering at the head of the dyked section which starts at the railway bridge.

The Pa Li Hu T'ung Dam Site

A possible dam site in the downstream region is, as already mentioned, at Pa Li Hu T'ung, 75 km. upstream from Meng Tsin. If there can be an assurance that this gorge is not along a fault line it seems otherwise suitable for a dam site. The rock is of very good lime stone. Especially on the north bank it is very massive and free from laminations. On the south side it is more laminated and will perhaps require extensive grouting near the dam site, but seems amply strong for a moderately high dam.

Reservoir capacity for detaining sufficient water during the passage of a serious flood so as to reduce the flow rate to a quantity which the downstream dyked section can carry without breaching, depends naturally upon the width of the valley, the slope of the valley and the height of the dam—and—the nature of the flood wave. The width and the slope of the valley are fixed and can be determined by surveys. We must try as well as we can to determine the volume to be detained from the available hydrometric measurements, and then the height of the dam must be made sufficient to form a reservoir storage which we deem adequate for reducing the flood flow to what the down stream dyke reaches can safely carry. Fortunately we are in possession of records obtained at the Shanchow station for the flood of 1933, the highest on record within the memory of living men. But from inquiry we also know that in the twenty third year of Tao Kuang there was a flood which in intensity was considerably greater than that of 1933. With regard to its volume, which is the most important thing, we know nothing. If we use the 1933 flood as basis for any calculations there must be an ample factor of safety made to take care of any larger floods such as that of Tao Kuang 23 year, as an increased flood intensity will most likely also mean an increased flood volume

which will require additional storage for its control. There has been no opportunity to go into this question fully ; but from some calculations of passing the 1933 flood through an assumed reservoir somewhat like that which will be formed by a dam across the Yellow River upstream from Meng Tsin, it seems that a dam not exceeding 65 or 70 m. will suffice for controlling the maximum Yellow River floods down to a quantity not exceeding 13,000 c.m.s. One dam, only 50 m. high, would have been sufficient to have controlled the 1933 flood down to this figure. The maximum discharge entering the dyked sections in 1933 seems to have been at least 23,000 c.m.s. Hence the proposed control would have decreased the flood flow nearly 45%. With a 60 m. high dam this flood could have been controlled down to 10,000 c.m.s. One diagram is attached showing how the 1933 flood could have been controlled down to 13,000 c.m.s. with a dam not more than 50 m. high, and also another diagram, showing how the largest flood in August 1935, of 18,500 c.m.s. could have been reduced to 10,000 c.m.s. using culvert openings the same as for the 1933 flood. The water level in the reservoir would have risen only to 42.2 m.

Usually in a flood detention project the openings through the dam or through tunnels around the dam abutments in the rocky sides have no gates, but are always left open. In the case of the Yellow River, however, it would be preferable, in view of the uncertainty of the largest flow, to have the openings as large as possible, but be able to reduce them with gates whenever the flow becomes more than what is wanted in the down stream sections where there are dykes. In this way more reservoir storage can be saved for controlling the bigger floods and it will also tend to lessen troubles from silt, gravel, boulders and ice. In the diagram showing the possible flood control with only one dam located upstream from Meng Tsin, culvert openings totalling as much as 800 sq.m. were used in the calculations. About 700,000,000 cu.m. of water and silt were temporarily impounded in the reservoir and again released, all during the course of four days in August 1933, the maximum outflow being 13,000 c.m.s. as already mentioned. The controlled flood would have lasted only two days longer than the uncontrolled flood.

Below the reservoir site proposed here, there are two important rivers coming into the Yellow River, namely the Lo Ho and the Chin Ho. Floods from these two rivers may increase the controlled outflow from the reservoir on the main river above what is desirable for the dyked section. Consideration of this possibility is therefore necessary.

On the Chin Ho there can be found dam and reservoir sites very near the place where the river enters the plain from the mountains and the flood flow of this river may be controlled down to less than 1,000 c.m.s. On the Lo Ho and its tributary the Yi Ho there are also reservoir and dam sites to be had, but rather far upstream, and it is a question if they will control the floods sufficiently since a good part of the drainage area lies below the dam sites, and further investigation here is necessary. In the early July flood last year the Lo Ho and the Yi Ho added 7,000 c.m.s. to the flood of the Yellow River. A favourable feature is that the Lo Ho, the Yi Ho, and the Chin Ho very rarely seem to be in flood at the same time as the main Yellow River. The only time when this tends to happen is when serious floods develop from the Yellow River area between T'ung Kuan and Meng Tsin such as in the beginning of July 1935. For this reason it would be best to have the Yellow River dam and detention basin located as far downstream or as near Meng Tsin as possible in order also to control floods coming from the downstream area below T'ung Kuan. Such floods detained will allow the almost simultaneous Chin Ho and Lo Ho floods to pass down the Yellow River before the maximum outflow occurs from the main river detention basin. But all floods which are developed from the upstream areas such as from the Wei Ho area, or from the area upstream from Lung Men, almost never coincide with heavy floods from the Chin Ho and the Lo Ho. The meteorological conditions are practically always such as to prevent this from happening. But for the sake of safety the Chin Ho and the Lo Ho floods ought also to be controlled, especially in view of the heavy damage these floods can cause locally, such as when in 1935 the city of Yen Shih Hsien was completely destroyed.

The San Men Dam Site

The San Men rapids are formed by two rock islands which project out of the river making three passages from 30 to 40 m. wide. The south passage is called Kuei Men, the middle passage Shen Men, and the north passage Jen Men or Niang Niang Men. Boats take the middle or the Shen Men passage as the Kuei Men passage is on a curve and undoubtedly very difficult to navigate with the clumsy native boats. The north passage, or Jen Men, is said to be dry at low water and one can walk over to the north island.

At the time of visiting the San Men rapids the river had a discharge of about 5,000 c.m.s. The water was flowing strongly through all the three passages and the difference in water surface elevation between the upstream and the downstream side of the islands was at least four meters (if not five) as far as could be estimated. As the total width of the three openings is not more than 100 m. a heading up of say 4 m. would indicate a depth on the average of about seven or eight m. If the Jen Men is dry at low water this would make the other two passages a little deeper than above estimated but perhaps not more than 10 or 12 m. or about six to eight m. at low water. It is reasonable to assume, due to the high velocity, that no gravel or boulder deposits overlie the bed rock. If the two passages Kuei Men and Shen Men were very deep the flow through them at low water would be quiet. On the contrary the flow is said to be swift and turbulent which indicates a shallow depth. Moreover, the rock at Shen Men as already mentioned is an exceedingly hard gneiss or granite. For this reason the flow has perhaps not been able to grind too deeply into the passages which seemingly have remained unchanged in historic times.

The San Men is a hard, indestructible sill which has been and is controlling the slope of the river bed for a long distance upstream from it. Geologically it is a very important feature for determining the physiography of the river.

Everything seems to point to the probability that San Men would be a highly suitable and easy place whereupon to construct a dam for flood control purposes, except that the rock on the north side, not far above water level, changes into a metamorphic and sedimentary formation of much softer quality,—shales and sandstone being the predominating rocks. The clearly visible contact line between the granitic and the sedimentary formation goes obliquely across the river from the dam section line on the north bank to a point upstream of San Men on the south side. Upstream of this contact line the rock is metamorphic and sedimentary. The south bank is thus all solid hard rock while only the underlying part of the north bank is of hard rock and the overlying part of the softer sedimentary and metamorphic rocks. How this will affect the dam construction is difficult to say without a thorough investigation. The north bank is also not so high as the south bank and it may not be high enough if the dam will have to exceed 60 m.

The detention basin for flood control which would be formed upstream from San Men would drown out much good land and a number of villages. While the important town Hui Hsing Chen lies high enough, it is a question if Ping Lo Hsien opposite Shanchow on the north bank would not be entirely submerged. Shanchow itself, which lies fairly high, may be safe, however. But the storage for flood water is a good deal better than that formed by a dam at Pa Li Hu T'ung as the valley above San Men is both broader and flatter. A dam at San Men may therefore not have to be so high as at Pa Li Hu T'ung and hence be a good deal cheaper. Only a thorough study however, will reveal the pros and cons of these two dam sites with regard to storage, height of dam, all the social considerations involved and general cost.

A feature, already touched upon and highly important, which should be considered when selecting the dam position, is that the San Men flood detention basin will be rather far upstream and unable to control floods mainly developing downstream from it. On the other hand the Pa Li Hu T'ung dam is about 120 km. downstream from San Men and will thus control important increases in flood flow which are now known to take place at times below Shanchow. The greater part of this increased flow may come from an area lying just between San Men and the Pa Li Hu T'ung dam site. This seems to have happened in early July of 1935. An hydrometric study of this part of the river seems necessary, therefore, before making definite conclusions with regard to the flood flow importance of the river between San Men and Pa Li Hu T'ung or for that matter right down to another possible dam site near Hsiao Lan Ti 30 km. upstream from Meng Tsin. Any of these dams will be so costly to build that it perhaps can be a question

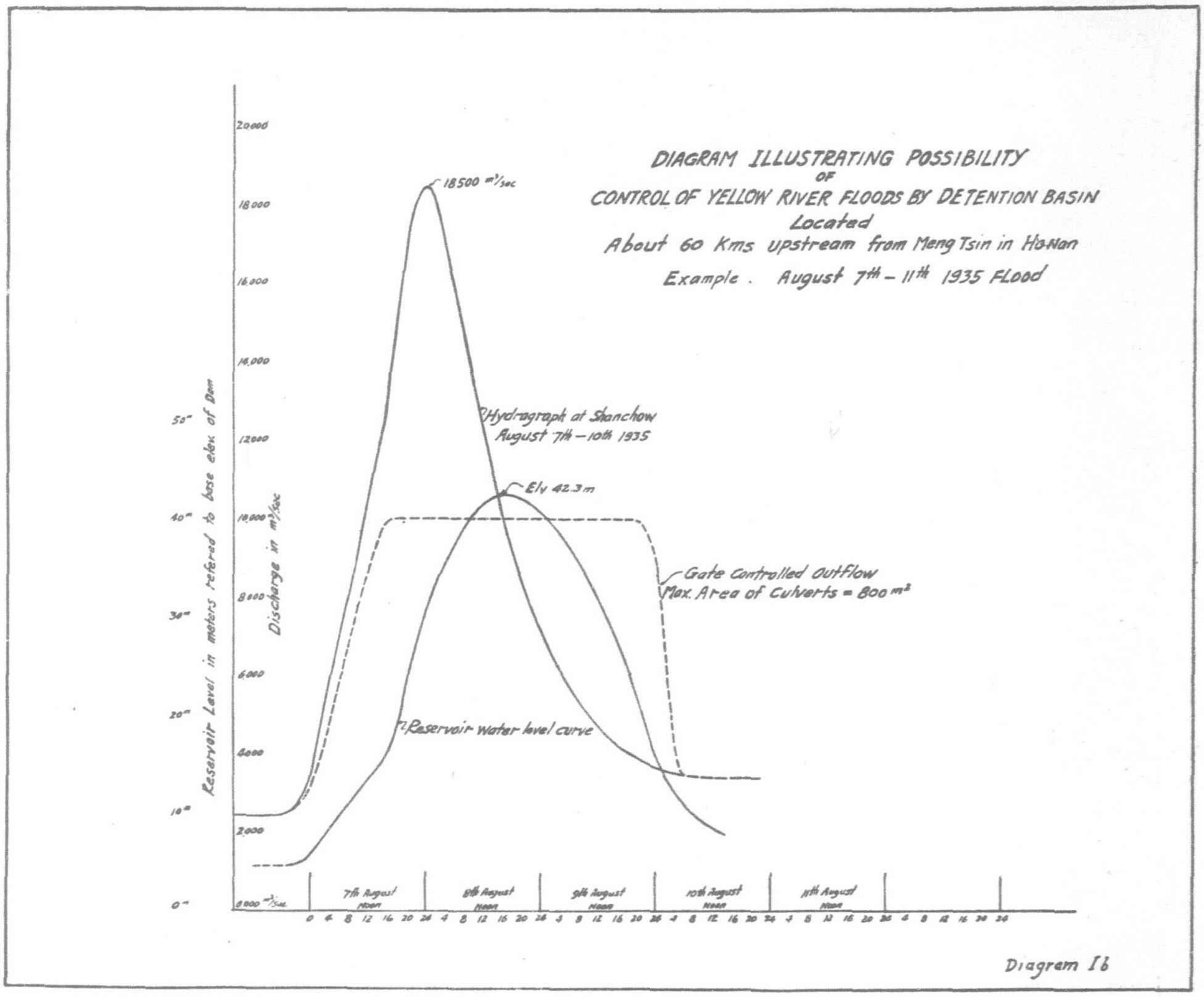


Diagram 1b, showing different Stages during the Flood from August 7th-11th 1935

only of considering one such dam which ought to be placed where it will do best service, and if possible also cause least inconvenience to the people and destruction of their land.

Access to Dam Sites

Considering the Lung Hai Railway as the base communication artery from which construction materials can be shipped to any of the dam sites, the San Men site will undoubtedly be the easiest to reach as it lies only about 10 km. from the nearest railway station. But the road is over difficult ground. However, by studying the gullies which run down to the river, a good road on a flat grade can unquestionably be constructed for relatively little money to the San Men Rapids from the nearest railway station, either the Kuan Ying T'ang or Chiao K'ou stations.

In order to reach the Pa Li Hu T'ung site it will be necessary to construct a road about 40 km. long from Hsin An Hsien railway station. For the first 20 km. this road will have to cross a number of deep loess gullies involving expensive construction. But after the Cheng Ho valley has been reached, the road is easy to construct to Tung Wo. Some difficulties will have to be overcome between Tung Wo and Hsi Wo as the road there will have to follow either the rocky ledges along the river bank or cross a mountain range in a more straight direction. From Hsi Wo to the Pa Li Hu T'ung dam site there is no particular difficulty in constructing a good road.

On the whole the access to the dam sites will not involve any particular obstacle. The expense of building a good road from the railway to any of the dam sites will be only a small fraction of the total cost of the dam construction.

Back Water Destroys Villages and Land

The back water influence, assuming a dam from 65 to 70 m. high, will extend almost 100 km. upstream from the dam under serious floods. The general slope of the valley is on the order of 1 : 1,000 as can be judged from the fact that the Taku datum elevation of the low water surface at Meng Tsin is about 118 m. and that at Shanchow 290 m. which gives a difference of 172 m. in elevation. The distance between the two places is about 215 km. if the map made in the reign of Emperor Kuang Hsu's 18th year can be trusted. As far as we had occasion to compare this map with the actual conditions, it seems fairly correct in distance and directions of the river. This will give a slope of about 1 : 1,250. From Shanchow down to San Men, however, a distance of 25 km., and from Meng Tsin upstream to Ching Tze Yen, a distance also of about 25 km., the slopes are somewhat flatter than 1 : 1,250 and the average slope through the rocky section from San Men to Ching Tze Yen will then be about 1 : 1,000.

With regard to the destruction of land and villages caused by the back water of the dam during the summer flood periods, it will be necessary to remove quite a number of villages to higher ground. The reservoir formed by a dam at Pa Li Hu T'ung will perhaps affect the least farmland and villages, a dam at Hsiao Lang Ti more land than the Pa Li Hu T'ung dam, and a dam at San Men a still greater number of villages and amount of land.

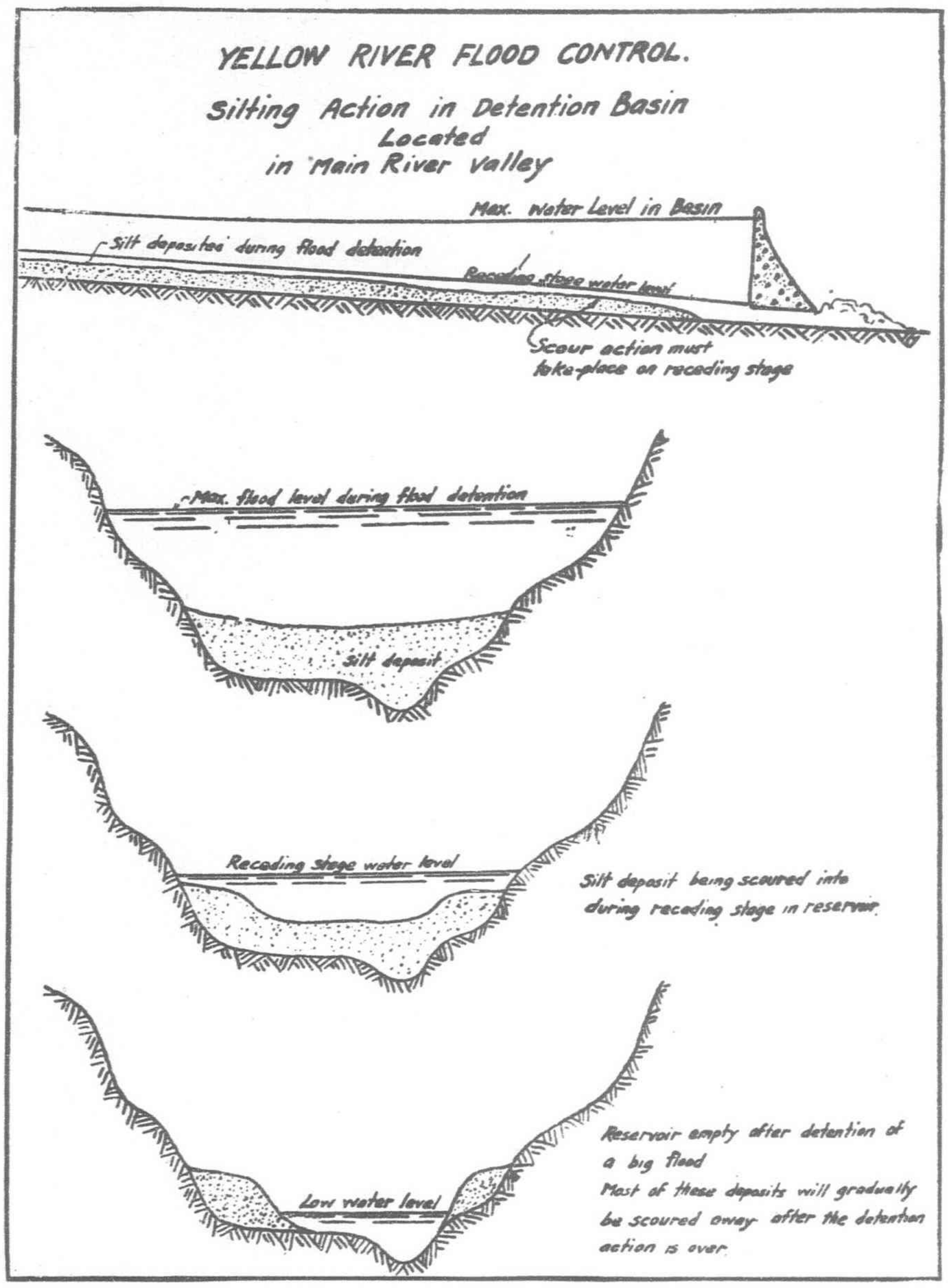
For the Pa Li Hu T'ung dam it will be necessary to remove to higher ground about 15 villages and a number of isolated dwelling places. The land submerged for a few days during the summer may be roughly estimated at 15,000 or 20,000 mou under the most severe flood conditions. Under ordinary conditions less than 10,000 mou of land will be affected. As the land will be available for winter wheat planting, the yearly loss to the farmers will not be so heavy and their land will not be flooded with equal severity every year. It will not be necessary for them to move away from the district as new land will rapidly be formed in the many side gullies which will become filled with silt, be cultivated and soon compensate for loss to crops at other places. In fact the final result will be to raise all the present land situated in the convex bends and make it into high terraces which after some years can be freely cultivated, safe from flood dangers. This changed condition may perhaps be a gain upon the present conditions. The river will be flowing in a deep loess canyon, with almost vertical sides, from 400 to 500 m. wide on the average, as we today may see it near Hui Hsing Chen. It is only during the first few years after the dam has been built that some distress, which may call for help from outside, will be felt. But on the whole there does not seem to be any need for alarm that too much land is being destroyed. As already said, there may finally be a gain. With regard to the dam and reservoir upstream from Hsiao Lang Ti this will involve 18 to 20 villages and from 30,000 to 35,000 mou of land under maximum flooding conditions.

The number of villages involved if a dam is to be constructed at San Men may be considerably larger than at Hsiao Lang Ti, but probably not more than 30 and the land affected not more than 50,000 mou, practically all of which again can be safely cultivated after some years. And in any case it will always be possible to

plant winter wheat. But the affected villages must be removed or there may be disaster. There is no way out here. That a lively opposition will be encountered is self-evident, but may be overcome by compensation, reason and a slight pressure if the flood detention control project proves feasible after sufficient investigation.

Deterioration of Reservoir Due to Silting

Since the Yellow River contains as much silt as it does, it is only natural that fears are entertained that the reservoir may quickly become silted up and made useless. We know only too well that reservoirs built for storing water for power purposes have become silted up in the course of less than 30 years, e.g., the Austin Reservoir and the Zuni Reservoir in America. The newly built Lo Ho irrigation diversion dam, about 17 m. high with a storage behind of 8,000,000 cu.m., was filled to the brim with silt in only one small flood this year. Of course there were no culverts at the base of the dam, but, nevertheless, the silting possibility is there and must be carefully investigated. It may therefore be interesting for the time being to dwell a little upon the probability of reservoir silting, supposing a dam is built across the Yellow River upstream from Meng Tsin.



Silting Action in Detention Basin, Located in Main River Valley

The river valley at the bottom is relatively narrow averaging perhaps not more than 400 or 500 m. and is occupied by the flowing water from bank to bank. When a flood is passing down this valley and is checked by the dam, and at the same time partly passing out through the culverts, silt will begin to settle after the average velocity through the reservoir has become less than 1.3 or 1.2 m. per sec. For an outflow of 10,000 c.m.s. this will occur when the depth just upstream from the dam has reached about 18 m. The bottom of the reservoir slopes longitudinally 1 : 1,000 while the water surface in the reservoir begins, at least in the reaches near the dam, to assume a horizontal position. In other words, the heaviest velocity is not likely to be near the surface as in an ordinary river, but near the bottom. Much silt may here be caught by this heavier velocity and pass out through the culvert openings. Also as long as the reservoir is filling (inflow larger than outflow) there is likely to be much commotion and good velocities through most of the reservoir sections and relatively little silt may settle during this period. However, this action will gradually diminish as the reservoir fills up. As the time approaches when the reservoir level reaches its maximum and the outflow equals the inflow, (the time of the highest flood crest having already passed) then for a while the velocity through the reservoir will be very slow since the reservoir cross section is so large. The flow across any section will then practically equal the outflow. Assuming a depth of 50 m. a width of 700 m., and a flow through the reservoir of 12,000 c.m.s., the average velocity will only be 0.3 c.m.s. Heavy silting will undoubtedly take place except near the dam where the swift outflow through the culverts will keep the reservoir clear of silt for a few hundred meters back from the dam. (Here is an interesting study in velocity across any section in the reservoir due to inflow, outflow, area of section, and filling or draw down of storage space downstream from any section). That the large culvert openings possibly can be blocked by silt is absolutely out of the question, and no fear with regard to this need be entertained.

As the water level in the reservoir begins to decrease after one or two days it will gradually approach the top of the silt deposits which still are soft and non-consolidated. The receding water will begin to cut into the deposits and carry them away. As the river flow digs its channel deeply into these deposits, which it must do, the wet silt on the sides will also slide into the rushing water and be carried away. It will be a silt sluicing action on a grand scale. (See attached sketch.) The silt "cannon ball" effect so dreaded during silt sluicing operation of several Spanish reservoirs will perhaps not occur here since the silt is non-consolidated. In these Spanish reservoirs, culverts through the base of the dams are used for sluicing out the reservoir silt, an operation having taken place every 4 or 5 years for the past 600 years. Here is at least a precedent, only on a small scale.

Most of the silt will unquestionably be carried away during the days immediately following the flood. Some silt will be left on the sides and slowly be scoured away during the autumn and winter period, and before the next flood season there will not be much of the deposits left except in the side valleys and convex side of the bends where the current has no chance to act. But a channel will have been formed down to the original grade of a width equal to the width at present occupied by the flowing water. One thing, however, stands out. It will not be possible to have a self-scouring flood detention basin unless the stream is a perennial one, with a good low water flow. On intermittent flowing tributaries the basins will rapidly silt up.

On the Chia Ling River, a tributary to the Yang Tze Kiang at Chung Ching, I have seen a 2 km. long, 10 m. high and over 100 m. wide silt deposit being eroded away in less than two months. This deposit was left by a flood on the Chia Ling River which had been dammed up by the high water of the Yang Tze Kiang. When the water of Yang Tze Kiang went down, the deposits were rapidly scoured away by the relatively small Chia Ling River flow. I anticipate that the action of the Yellow River will be the same in scouring away the silt deposits left in the reservoir after the control of a flood wave. Furthermore, as big floods necessary to be controlled do not occur every year, the smaller floods, which are not backed up much by the action of the dam, will also have a good chance of digging into and carrying away the deposits.

On the whole it seems certain that at some times the reservoir will be considerably silted and at other times again cleared, a process which may go on indefinitely. A matter for investigation would be to find out how serious a silting period may become as regards reducing reservoir capacity, and then this must be allowed for in

designing the height of the dam. A relatively simple laboratory experiment may help much to arrive at an understanding of how the silting and scouring action in a reservoir of the slope and shape here available will develop when a flood is detained by a dam with culverts at the base.

Destructive Velocities

There can be no question that in the flood control project here proposed the flow control will have to be accomplished through culverts located at the base of the dam or through tunnels in the rock around the dam abutments, or both. In the Miami flood control project in America the dams are earth dams with built-in, concrete culverts at the base. The Englewood dam is 105-ft. high, (32 m.) and at maximum stage the outflow velocity can reach 60-ft. per sec. This high velocity as the water issues from the culvert outlets, is transformed by means of an artificially arranged hydraulic jump into the normal channel velocity of five or six feet per sec. This has been successfully accomplished. Although the huge earth dams with built-in masonry culverts at the base, through which there are such high velocities, are very conservatively designed and built, it must certainly be called a daring plan, especially in view of several great cities located below the dams. But the American engineers did not allow this to stop them from going ahead with their flood control projects and they went about the task of solving the Miami valley flood problem with all the theoretical knowledge at their disposal. They solved the destructive velocity problem by experiments and theory. The control works have stood the tests of several high floods and have so far functioned to perfection.

In the case of the Yellow River flood detention basin project, as here barely outlined, we shall be up against velocities a good deal higher than those which the American engineers had to face. But the dams can be built in canyons of good rock, and careful and conservative designs adopted, utilizing the best of modern materials. It would be strange if the hydraulic jump theory could not also be applied in the case of higher velocities, or some other form of velocity transition construction worked out which will act satisfactorily here also.

The grinding force of the coarse bed load movement, especially during middle and low stages of the river, may be a cause for concern. The culvert or tunnel inverts will have to be made of special tough material to withstand abrasion and make the periods between relining as long as possible.

Effect of Control on River Bed in the Plain

During the control of a flood it is quite certain that a considerable amount of silt will be deposited within the detention reservoir especially in its middle reaches and that the outflow through the culverts for a couple of days during maximum outflow will be almost free from silt. It seems reasonable to assume that this clarified water will scour away and carry with it to sea a considerable amount of silt from the channel in the plain and thus deepen it. (The channel is assumed to be regulated and protected against becoming widened).

When the water in the detention reservoir becomes lowered sufficiently to begin to cut into the deposited silt the silt content in the reservoir outflow will again increase and a refill of the down stream channel will occur. As regards this action we may consider the following :

After a severe flood period the river flow usually remains quite high for a number of days,—let us say that it averages about 5,000 c.m.s. for the next 10 days. And let us further say that as a result of silt scoured away from the reservoir the silt content is increased from an average of 10% in the detention basin inflow to an average of 15% in the basin outflow. This increased 5% will in 10 days correspond to a reduction in the reservoir silt deposits of about 165,000,000 cu.m. of settled silt. A part of this silt will be redeposited in the channel through the plain, such as now frequently is the case during a flood, and the rest will be carried away to sea. If the silt scouring in the detention basin continues at the same rate silt will practically all have been scoured away during the following 15 days. Silt cannot be accumulated in the reservoir to a much greater extent than about 400,000,000 cu.m. due to the fact that the reservoir cross sections become much reduced resulting in an increased velocity which will carry the silt with it through the reservoir. There will be an automatic regulation here which should not be overlooked. Most likely the detention basin action will mean that the intense and short silt periods in an uncontrolled wave will, in the outflow from the dam, be distributed over a much longer period with a much reduced silt percentage.

The effect of increasing the silt percentage from, say, 10% to, say, 15% for a number of days, is not likely to have any very serious effect on the down stream channel especially when one considers that the channel most likely has previously been scoured during the days of high flow when the water had very little silt in it. The channel from Meng Tsin to the sea is 800 km. long. If it has been deepened one meter over a width of 200 m. it will mean that it will have gained an enlargement of 160,000,000 cu.m. to be refilled by silt scoured from the reservoir. In the long run the effect of the control will probably be to change the difficulty with the river from the present reach in east Honan, Hopei and west Shantung. to the reach downstream from Tsinanfu, especially near the mouth where most of the silt will finally be deposited. This will be a distinct gain.

If one considers the question from a permanent river regulation point of view, there can be no question that such regulation can be feasible only if the exceedingly silty and violent flood periods are put under control as here advocated. It may mean not only reduction of the flow to a quantity which can be passed through to the sea, but also the silt may be put under control and in a similar manner distributed so that it can be handled.

The Japanese Steel Industry

Apart from the United States, the only serious competitor in certain iron and steel products which European makers have to meet in the Asiatic markets, particularly the Far East, is the growing industry in Japan, which is also seeking openings in South America. This situation of affairs lends some interest to a study of the market in Japan.

Between 1930 and 1934 the consumption of iron and steel in Japan has increased by 50 per cent, the native production has been doubled and the exports have not only quintupled, but further rose from 350,000 metric tons in 1934 to 432,000 tons in 1935. In view of this development one of the questions which arises is as to whether the Japanese market will continue to absorb the 300,000 tons of rolled products from abroad that it consumes annually at the present time, and a second one is as to whether Japanese competition is to be more strongly carried on in external markets where such rivalry is possible.

In so far as the inland market is concerned it is undeniable that the progress made by the native iron and steel industry and the extensions already in hand will result in a curtailment of the market for foreign products. Already the imports of rails and wire products have been reduced to a minimum, and a similar observation also applies to thin sheets. No doubt the large orders of the arsenals and shipyards have permitted of the maintenance of the imports of thick plates and medium sheets, but even if the military budgets preserve their present level new rolling mills are being brought into activity and will be able, in the near future, to supply a good part of the plates which are imported to-day. A more favorable outlook is suggested for wire rods, tin-plates, tubes and hoops, and a beginning has now been made with the production of the last-mentioned product. Summarizing the position, the Secretary expresses the opinion that the disposal of rolled steel products will become more difficult and a slow retrogression in the imports is to be foreseen. A radical elimination of foreign deliveries, however, is not to be feared, as it would clash with the policy of low prices pursued by the Japanese Government, which has every interest in the maintenance of a certain play of competition.

Concerning markets outside of Japan the eventuality of the competition of rolled products of Japanese production in all the markets in the Far East and even in South America must be seriously envisaged. At present Manchoukuo absorbs 80 per cent of the Japanese exports (275,000 tons out of the total of 432,000 tons in 1935 were sent to Kwantung and Manchoukuo). The bringing into operation in Manchoukuo of the Showa Steel Works, with a manufacturing program of 70,000 tons of rails and 60,000 tons of bars and sections, will restrict the sale possibilities of Japan in that country.

Tumen-Chiamussu Railway Completed

In the wilds of North Manchuria, sparsely populated, remote from civilization, and devoid of quick means of conveyance, though bandit-infested no longer, nothing can work such wonders as the development the railway.

Mutankiang, formerly only a small station southeast of Hengtaohotze on the Eastern Section of the Chinese Eastern Railway, has been expanding since the new Line from Tumen on the Korean border reached there on its northward course to Chiamussu on the Sungari.

As this new line was extended north to Poli in January, 1936, that obscure village became suddenly inflated into a town of 14,000 people in the course of only one year.

In is now the turn of Chiamussu, the northern terminus of the Tumen-Chiamussu Line to undergo a like inflation process after the new line was completed, and the whole of 580 kilometers from the southern terminus of Tumen was thrown open to traffic on January 15 last.

Viewed geographically, at the present stage of development in North Manchuria, Chiamussu is shut off on both the north and west sides by a wild mountainous country, with its sole redeeming feature in the form of Holi Colliery, 56 kilometers due north, to which a coal line runs, starting at Lienkiangkou, just opposite Chiamussu across the Sungari.

This geographical handicap is, however, more amply set off by several advantages, old and new, which it enjoys.

Besides having the coal mine within convenient range, the town poses as one of the best river marts only second to Harbin on the Sungari, handling large cargoes for loading and landing.

Second, Chiamussu has an inexhaustible supply of the finest water in North Manchuria which is an important factor for an industrial center. In this connection, the proximity of the Holi colliery must be reckoned with.

Third, situated as the town is on the bank of the Sungari, it has remained free from the visitation of floods.

Even the great inundation between July and August, 1932, could not touch Chiamussu, while Sansing (Ilan), located south-southwest, was literally submerged. Epidemics broke out and spread fast in the flooded areas all along the river, and people flocked to Chiamussu in quest of a safe refuge and settled down there, swelling the population greatly.

The Town of Chiamussu, lately joined to Tumen by railway

Fourth, by the radical reorganization of the administrative districts of Manchoukuo in December, 1934, Chiamussu was made the capital of Sankiang Province (The Three River District evidently derived its name from the three rivers, the Sungari, the Ussuri flowing along the eastern boundary, and the Amur running the full length of the northern border), comprising fourteen prefectures.

Accordingly, the town is now a political and strategic center, not to mention its commercial and industrial possibilities.

Fifth, the recent railway facility makes all the difference in the world. By this railway, the distance from Chiamussu to the nearest seaboard outlet has become shortened to only one-third of what it was.

Its connection by the new line with the triple ports of North Chosen (Rashin, Yuki, and Seishin), on top of its waterways facility has more than doubly accentuated its commercial significance.

That Chiamussu has been pushed to the front among the towns of North Manchuria is only of comparatively recent date. A dozen years or so ago, it was a hamlet of a hundred odd dwellings. Prior to the Manchurian Incident, in 1931, there were not quite four hundred houses there. An exodus of villagers took place as the district was terrorized by the men under the insurgent chieftains like Li Tu and Ting Chao in post-Incident times.

The Japanese troops despatched to Chiamussu to protect the inhabitants were subjected to severe ordeals past description, literally surrounded by a number of insurgent bands of varying sizes, in addition to the fanatical gangs such as the Big Sworders, Red Lancers, etc.

Thanks to the sustained pluck of the troops, peace and order were established and confidence restored, and the town was started on the road to healthy growth.

The name of Chiamussu became familiar to the Japanese at home as the first batch of 500 farm immigrants recruited in Japan landed at Chiamussu in October, 1932, on their way to their destination, Yungfengchen, now known as the Yasaka Colony.

The second batch of about the same number of immigrants followed in the track of their predecessors a year later and settled at Hunanying now called Chifuri Colony.

It is, by the way, the success of these pioneer colonies that has laid to rest the cries of scepticism, raised in Japan, as to the technical feasibility of Japanese immigration to North Manchuria in the face of apparently unsurmountable obstacles.

As a result, the gigantic scheme of settling 1,000,000 households in the course of twenty years, beginning from the current year; was prepared by the Tokyo Government.

In passing, Chiamussu served also as the base of operations for the initial advance party of the gold prospectors sent out by the Kwantung Army Headquarters, Hsinking, and it was on the results of their reports that the Manchuria Gold Mining Company was launched. The company has been declaring three per cent dividends during the past few years, and looks likely to raise the rate for last year to five per cent.

At present, Chiamussu has a population of 43,000 composed of 40,000 odd Manchus 1,900 Japanese and 500 Koreans.

Town Plan

The Chiamussu Town Planning Office has drafted a town plan in the hope to see Chiamussu grow to a city of 300,000 people thirty years hence.

The town site includes on the north the delta on the opposite bank of the Sungari, and, with the railway station for the center extends about 4.5 kilos southwards, about the same distance eastwards, and 5 kilos westwards, covering an area of 70 square kilos in all.

To go into details of this plan, the residential quarter will take up 17.8 per cent; the commercial quarter 7.1; the industrial quarter 2.8; the delta opposite 0.4; the green area 30.9; the balance 41 per cent.

The extensive area stretching in front of the railway station is reserved for the new town site which will be divided into east and west by a central street running right across from north to south.

Government and semi-government buildings will be erected on the west side.

There will be the headquarters of the Manchoukuo Provincial Army, the Provincial Government Office, the Provincial Police headquarters, the Superior Court, the District Court, the Revenue Comptroller's Office, the Revenue Collectors' Office, the Assembly Hall, the Library, the Commercial Museum, the Hygienic Institute, the Chiamussu branch of the National Road-building Board, the Monopoly Office, the Central Bank, and the "Hsieh-ho Hui" (the Racial Concord Association), the Prefectural Agricultural and

Commercial Guilds, the Forestry Office, the Japanese Consulate, the Primary Schools, branches of the Manchuria Telephone and Telegraph Co. and the Manchuria Electricity Co., the Japanese Residents' Council, and parks, etc.

On the east side will be located the Municipal Office, the Railway Division Office, the Railway Hospital, and the Railway Club, with the Japanese and Korean amusement resorts, in addition to the Korean Residents' Council, the branch of the Manchuria Air Traffic Co., the Government Normal School, the Financing Union, the Police Office, the Police Training Institute, and the Market Place, not omitting a Manchu resort.

What remains of the town site will be cut up into the residential, commercial, and industrial quarters.

Very likely with a view to affording extra facilities to intending settlers, buildings of a temporary nature will be permitted to be put up on condition of being allowed to stand for not longer than ten years.

Actually in the new town site, a number of offices and houses have already been built by Japanese.

There are among the principal edifices construction of which is to be commenced on the return of the thaw the Provincial Government Office, the Agricultural Experiment Station, the branches of the Hsieho Hui, the Manchuria Electricity Co., and the International Express Co., the Financing Union office, etc.

The total estimate for building investments for the current year, 1937, is placed at G.Y10,000,000 and a lively building boom is expected to set in as soon as the weather permits.

Shortage of Timber

To the building contractors concerned, however, a painful shortage of timber supply is a source of profound worry.

As a matter of cold fact, out of altogether 200,000 "koku" (1 "koku" approximately amounting to ten cubic ft.) wanted for the current year, all that can be obtained is only 40,000 "koku." The only quarter from which the balance of 160,000 "koku" may be supplied is the wooded mountain sides north of the Holi Colliery, already mentioned.

Naturally, a sharp rise is feared on the timber market.

This situation has been created by the inclusion of the dense forest belt about Tangyuan across the Sungari and to the west of Chiamussu in the forest reserves from the consideration of preserving local peace and order.

To make matters worse, practically the entire timber stock of 130,000 "koku" available about Poli, about half way between Chiamussu and Mutankiang, has already been booked for Mutankiang.

To give distances in kilometers from Chiamussu to places of more or less interest :

To Hengtaohotze on the Harbin-Suifenho, (formerly Pogranichnaya Line) 35 ; to Tangnan 39 ; to the Yasaka Japanese colony 55; to the Chifuri Japanese colony 90 ; to Poli 160 ; to Tungho 198 ; to Mulan 273 ; to Hulan to the north of Harbin, 395 ; to Harbin 418.

A regular air mail line operates twice daily each way to and from Harbin.

Whilst Chiamussu used to be accessible to and from Harbin by steamboat in warmer months, and by bus in winter, both air and rail trips have now been made available additionally.

The rates from Harbin to Chiamussu follow :

Steamboat (3rd class) G.Y4.10 ; railway (3rd cl.) GY12.40 ; bus GY25.10 ; air G.Y46.

Of course, the Sungari remains frozen over during the winter, and while so, a journey along the river has to be made either by bus or by air.

From May to autumn or the middle of November, a trip by steamboat is not at all disagreeable because of the picturesque and exotic scenic views that may be had from on board.

The bus line is not yet altogether free from the risk of bandit hold-ups, and is moreover liable to cancellation of a few trips on end according to weather conditions. Besides, travelling by bus from Harbin to Chiamussu one has to stop overnight twice on the way. This raises the travel cost up to nearly what is wanted by air, which affords the triple advantages of absolute economy in time, and greater safety and comfort, to boot.

In Eastern Manchuria, the Harbin-Suifenho (Pogranichnaya) Line formerly enjoyed denser traffic than any of the Hsinking-Tumen Line connecting with the Korean seaboard ports, the Harbin-Lafa Line, the Tumen-Chiamussu Line while extended only as far as Poli and the Chaoyangchuan-Kaishantun Line (the last mentioned on the Korean border), but since the Tumen-Chiamussu Line became open right through to its northern terminus, Chiamussu, the daily passenger traffic has increased to 3,000 on an average, as against 2,000 passengers on the Harbin-Suifenho Line, thereby outstripping the latter by a good deal.

The future of the town of Chiamussu looks roseate, to put it mildly, destined to all appearances to grow into a commercial and industrial centre, as previously hinted, next to Harbin along the Sungari.

Poli Station

Next to Chiamussu, the town of Poli has benefited most by the completion of the Tumen-Chiamussu Line.

Poli is about 200 miles north-northeast of Mutankiang. It was for some time the northern terminus of the line under construction. But, on the recent opening of the entire line to traffic, it is now a stop-over station where passengers from either terminus remain overnight.

In the pre-Incident days, its population was not quite 6,000, without a single Japanese. The brigandage scare that followed the Manchurian Incident drove many rural folks to Poli as a place of refuge, and with the gaining of railway facilities, it has become the largest town on the line, with a population of 16,000, inclusive of nearly 1,000 Japanese.

On the Manchoukuo side the Poli Prefectural Government Office is located here, besides the Post Office, the Forestry Office, the Monopoly Office, the Telephone and Telegraph Office, the branch of the Central Bank with the Commercial and Agricultural Guilds, the Financing Union office, and the Prefectural headquarters of the Hsiehho Hui (the Racial Concord Association) with its Young Men's Association.

On the Japanese side, there are already the Japanese Residents' Council with a primary school, the railway engineers' sectional and construction offices, sub-branches of the Manchuria Electricity Co., and the International Express Co., the Fire Brigade, branches of the ex-Servicemen's Association and the National Defence Women's Association, the Japanese branch of the Hsiehho Hui, and the Korean Residents' Council with a primary school. The opening of the Consular police office shortly is also on the cards.

Produce Center

Situated in the south of a fertile plain watered by the Woken River with its tributaries the Chihuli and Pahuli, Poli is one of the chief distributing centers for staple produce such as beans, kaoliang, millet, etc. in Sankiang Province.

Actively operating on the Poli produce market are agents of the Mitsuis and the Mitsubishis, on the Japanese side, and the Wassards, the Kabalkins, and the Dreyfuses on the foreign side.

Large piles of bags of cereals can be seen crowding the open storage ground on the railway station premises throughout the produce season.

Produce despatches from Poli are estimated at over 1,000 carloads each season : those from Hunanying, in which the second Japanese colony of Chifuri is, 1,300 carloads ; and those from Woken 1,000 carloads.

Whilst the railway went no farther north than Poli, all grain stock from the neighboring centers were put on the Poli market. Now that the railway runs through both Hunanying and Woken, part of their stock may not be sent to Poli any longer. However, since none of the intervening stations have yet obtained reliable financing mediums, the major balance of goods seems more likely to continue to be put through the hands of Poli dealers.

Apart from this, produce stock yielded in the great Paoching valley lying to the northeast of Poli amounts to between 1,500 and 1,600 carloads which are bound to be sent Poli way.

The produce put out about Sansing (Ilan) on the Sungari used to be drawn to Sansing, but in view of the railway facility made available lately, the trade channel is undergoing a change in favor of Poli which is now expected to attract altogether about 3,000 carloads of produce a season.

In addition, within the hinterland, Poli holds immense coal reserves at Pataokang and Taoshan roughly estimated at 100,000,000 tons by the geological experts of the South Manchuria Railway Company.

(Continued on page 125)

China Buys Another German Dredger

Messrs. Schichau, Elbing, Build World's Largest Giant Drag Suction Dredgers for Whangpoo Conservancy Board

(Continued from February, 1937)

A "TELEDEP" draught and displacement instrument supplied by Messrs. Dobbie McInnes & Co., Glasgow, is installed in the operating room for indicating the conditions of loading in the hoppers during dredging.

Dredging Arrangements and Equipment

The main hoppers, which are situated on either side of the center well, amidships, have an aggregate capacity of 2,850 cubic meters (3,700 cubic yards) to deck level. The hoppers are constructed with sloping sides, with cross girders at bottom which divides each hopper space into ten compartments, open at the bottom, and closed by means of a double row of steel cased doors lined with oak wood. The doors Fig. 4 are supported on strong forged steel hinges fitted with manganese steel pins and bushes and when closed press against oak wood frames lined with leather jointing. Each door is raised by two steel wire strops fitted with stretching screws and connected to equalising gear in order to ensure equal loads on all the supports.

Each pair of door wires is further connected to a second equalising gear Fig. 5 to which are attached the main chains leading to a sliding motion girder running along continuous gangways on the hopper tops. The sliding girder for opening and closing the hopper doors is actuated by means of hydraulic rams situated one on either side at the after end of the hopper gangways. The rams are arranged to work at a pressure of 600 lbs. per sq. inch.

This arrangement makes it possible to operate each pair of doors separately or any number of them together.

During loading of the hoppers the main door chains are supported by means of a forged steel cottar secured to a cast steel stool on the hopper gangway which also forms the sliding faces for the hydraulic motion bar.

Perhaps the most interesting part of the whole dredging gear is the dredging head, or draghead, and the outboard suction pipe for conveyance of the dredged material to the pump. The utmost care has been taken in the design of this equipment in order to reduce to a minimum friction losses at the draghead entrance and in the suction pipe, and with this object in view the various parts and sections have been made of stream-line form.

The suction pipe is arranged in a strong girder frame of steel plate and angle construction secured to massive steel castings at either end; the lower casting being arranged with bearings and shaft to take the draghead, the upper casting having side journals of large diameter which are supported in heavy bearings secured to the centre well sides. Attached to the upper casting is a cast steel machined sliding joint which rotates in a steel casting secured

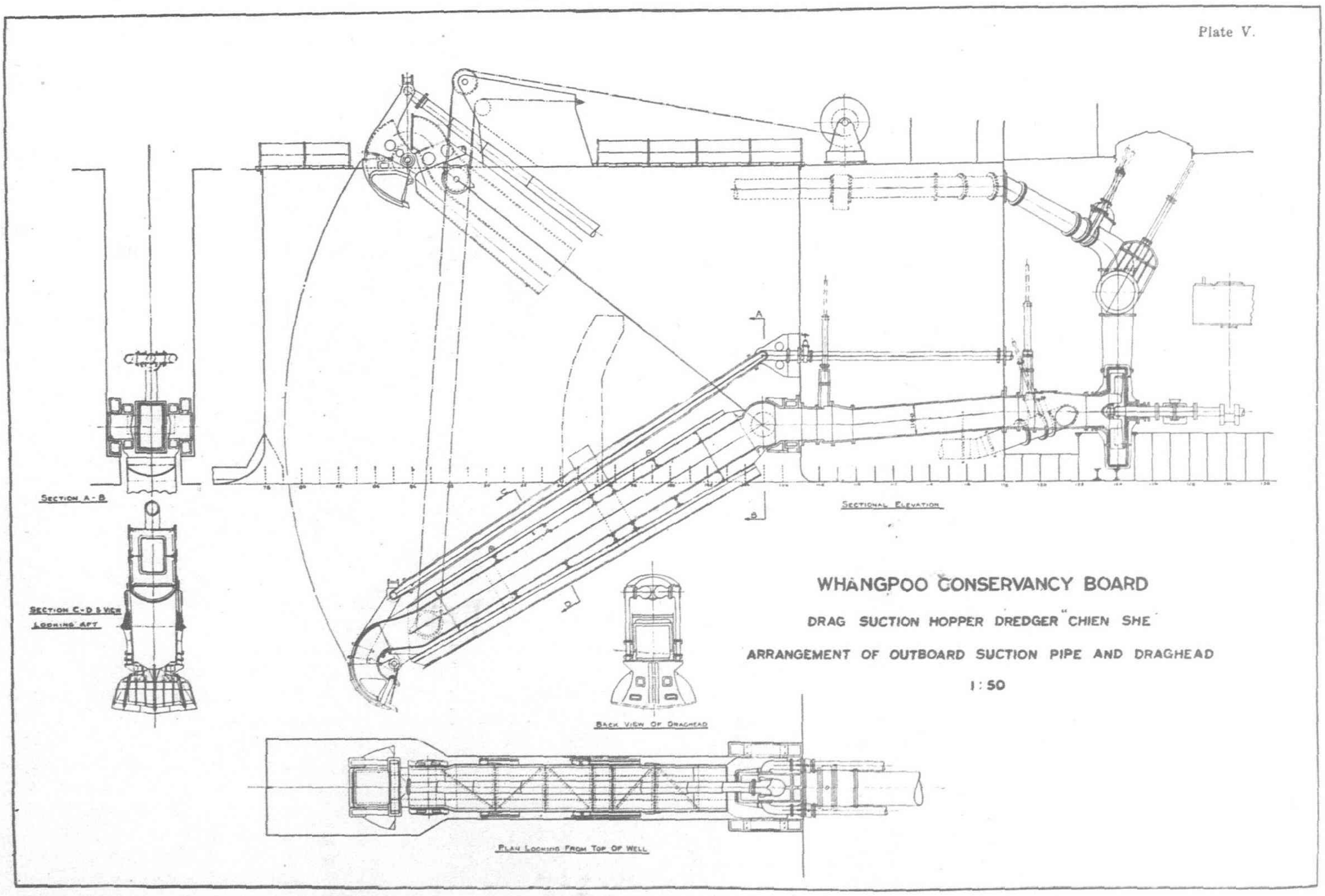


Plate V.—General arrangement of the outboard equipment together with the pipe line and hydraulic sluice valves in connection with the dredging pump

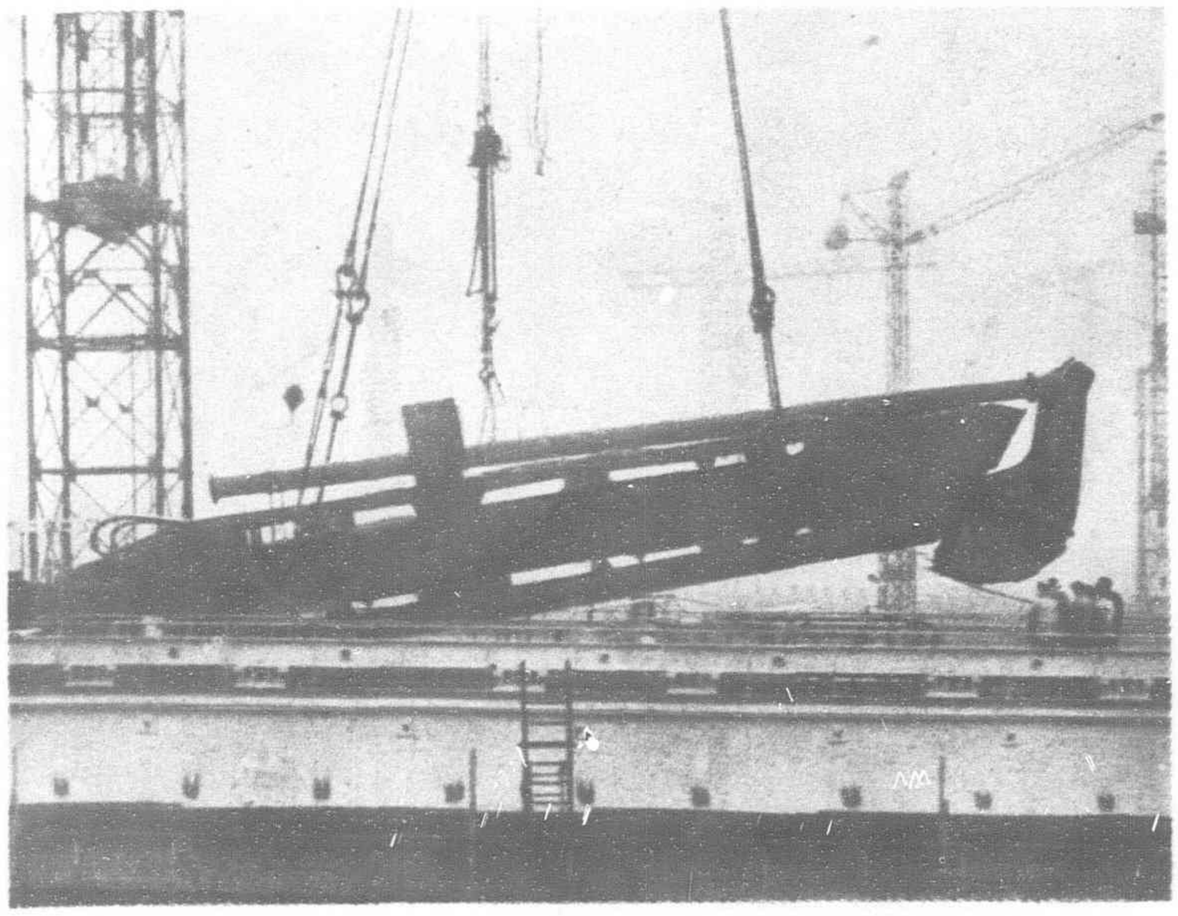


Fig. 10.—General view of the suction ladder and draghead

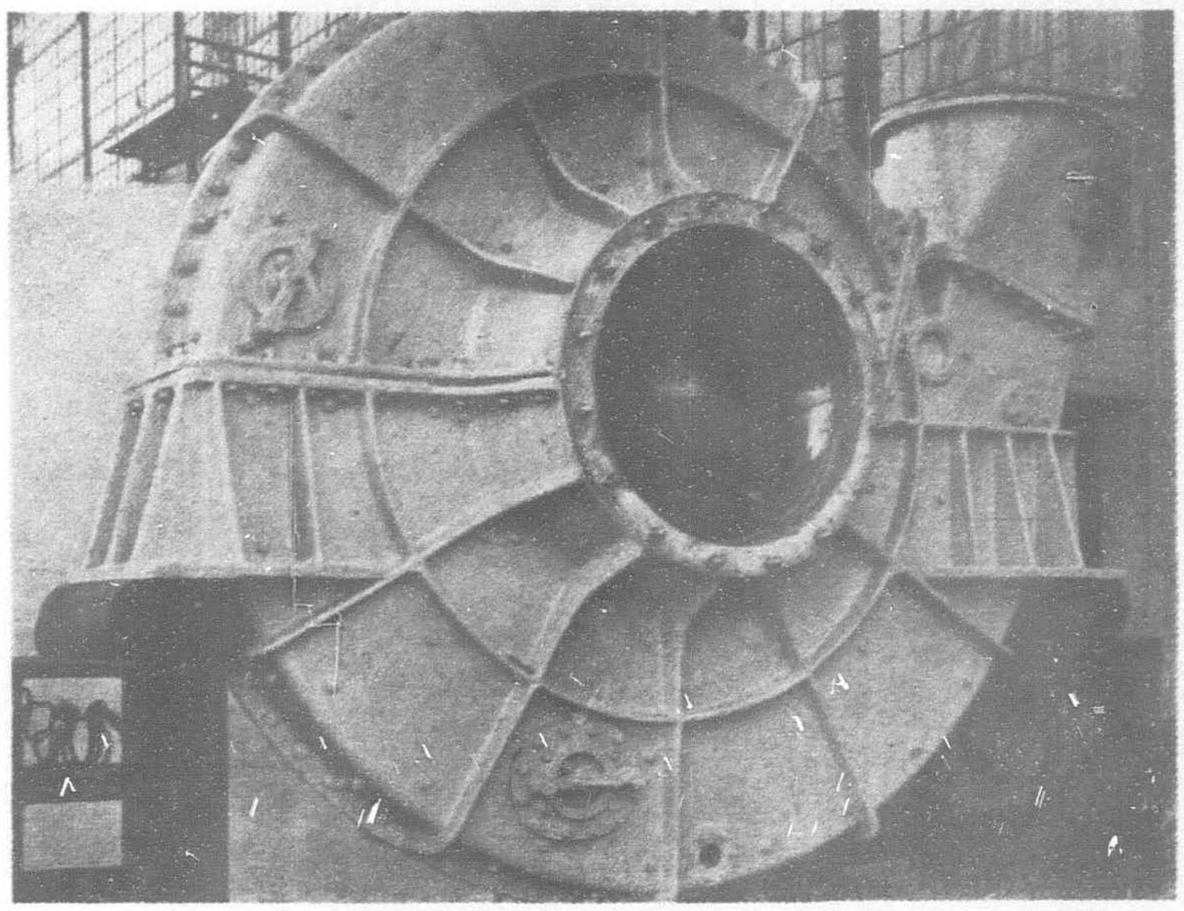


Fig. 13.—Main dredging pump

to the forward end of the centre well plating, the joint being made watertight where the sleeve passes through the hull, and connects to the main suction pipe to the Dredging pump. The details of this connection are clearly shown in Figs. 6 and 7.

The general arrangement of the outboard equipment is shown on Plate V. together with the pipe line and hydraulic sluice valves in connection with the Dredging pump.

It should be noted that the dredging pump has been kept as low as possible in order to reduce the suction lift.

The lower part of the outboard suction is fitted with an interchangeable cast steel suction draghead of massive design and construction, fitted at the entrance with manganese steel cutting blades and having vertical grid plates for the purpose of excluding large objects and wreckage from entering the pump. Three different sizes of dragheads have been supplied measuring six, eight and ten feet respectively on the cutting edge, one of which is illustrated in the two views Figs. 8 and 9. The inner surfaces are streamlined throughout and the head is cast with a water jacket fitted with pressure water jet openings facing in the direction of flow of the spoil, which can be used to provide water lubrication on the inner skin of the casting when dredging stiff materials.

Another interesting and important feature of the draghead is the mechanism for maintaining a constant angle at the cutting edge of head irrespective of dredging depth, tidal variation or loaded conditions of the dredger.

This arrangement which is shown in Fig. 9 and Plate V. consists of two cast steel, lever shaped, arms mounted on top of the draghead, connected at the upper end to a branch piece, the ends of which form a journal rotating in the lever ends. These side arms are cast hollow and serve to convey the pressure water service to the water jacket in the draghead. The branch piece joins a "Mannesman" solid drawn steel pressure water pipe which in turn is connected to a second cast steel branch piece mounted on bearings secured to the forward end of the centre well. By means of this mechanism, the cutting angle of the draghead, after having been set to suit the conditions of dredging, remains fixed for any position of the head, the variation of angle being taken up by a sliding sleeve secured to the upper part of the draghead. A general view of the suction ladder with draghead attached is shown in Fig. 10.

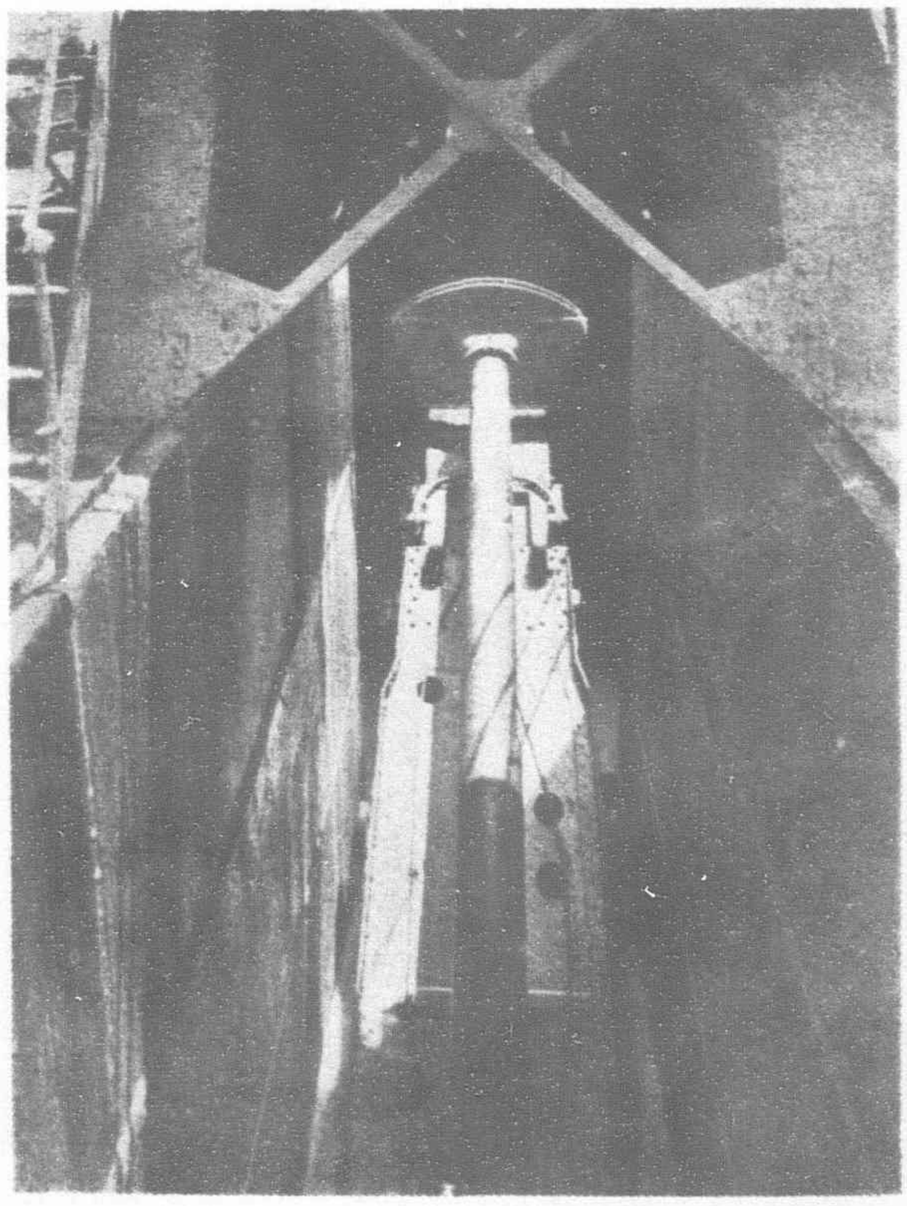


Fig. 11.—View showing center well and suction ladder

The suction ladder is housed within the centre well and has heavy wood faced fenders on both sides which bear on doubling plates on the well sides during dredging. The lower end of the suction pipe and ladder is suspended from the hoisting platform by steel wire ropes, raised and lowered by means of the hoisting winch already described. A view of the centre well and suction ladder is shown in Fig. 11 and Fig. 12 shows the draghead in the top position.

The main dredging pump is of the centrifugal type, built of cast steel sections bolted together and lined internally with manganese-steel wearing plates. The impeller is of the semi-shrouded type 8-ft. 6-in. diameter over tips, having four mild steel blades 20-in. in width riveted to vanes cast on to the impeller disc. The impeller shaft is $13\frac{3}{4}$-in. diameter at the bearing and connects through a "Michell" type thrust block to the main pumping engine. The impeller shaft bearing is fitted with a patent sand excluding device to which a supply of clean water under pressure is kept in circulation.

The pump which may be seen in Fig. 13 and impeller Fig. 14 has a water pumping rate of 18,000 tons per hour at a speed of 120 revolutions per minute when delivering through the distributers at the hopper tops, and when dredging thick mud, having an in situ density of 1.8, the pump can fill the hoppers with a load of 4,000 tons in less than 20 minutes.

The arrangement of suction and delivery piping and valves makes it possible to draw the dredged up material from the draghead and deliver it direct to the hoppers, or if required, it may be pumped overboard for reclamation purposes. It also permits of the hoppers being pumped out and discharged overboard.

Each particular method of pumping is controlled by manoeuvering appropriate sluice valves in the suction and discharge pipes, all of which are hydraulically operated by control levers, arranged in the operating room on the bridge deck. The main discharge pipe from the pump is divided at the main deck level into two separate discharge pipes leading to the port and starboard hoppers respectively, each having five outlets or distributors spaced at intervals along the length of the hopper and fitted with a hydraulically operated sluice valve for control of the loading and to ensure an equal distribution of the load in the hoppers.

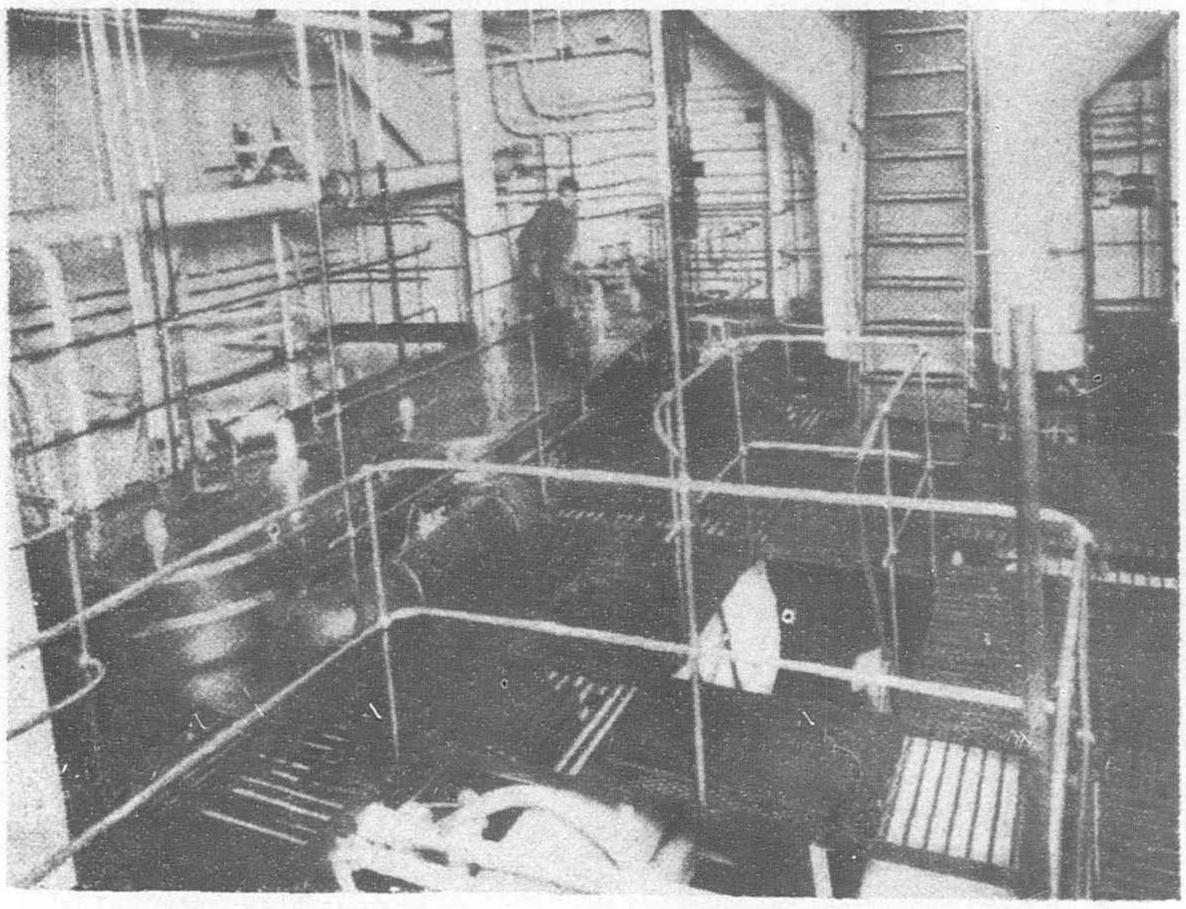


Fig. 18.—General view of the propelling engine room top

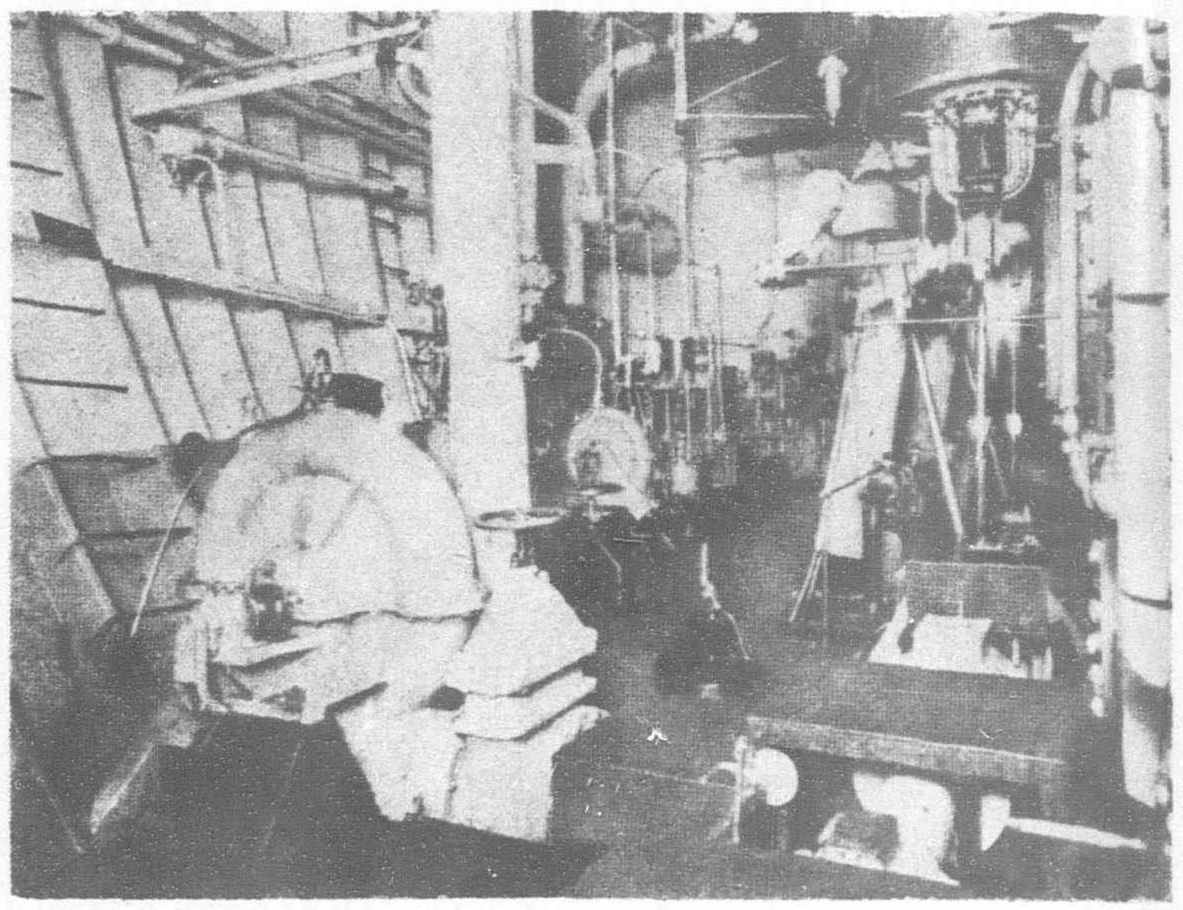


Fig. 19.—General view of the propelling engine room port

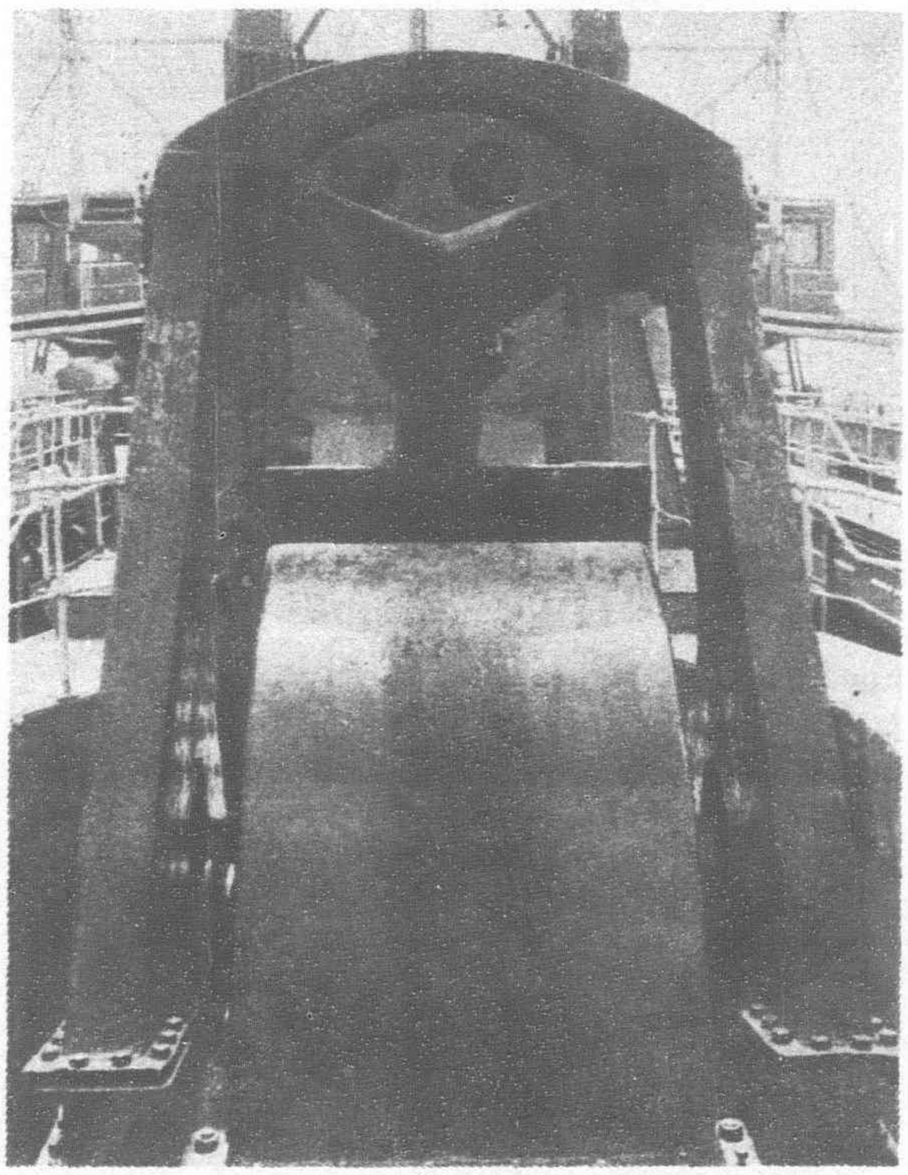


Fig. 12.—Suction ladder and draghead in top position

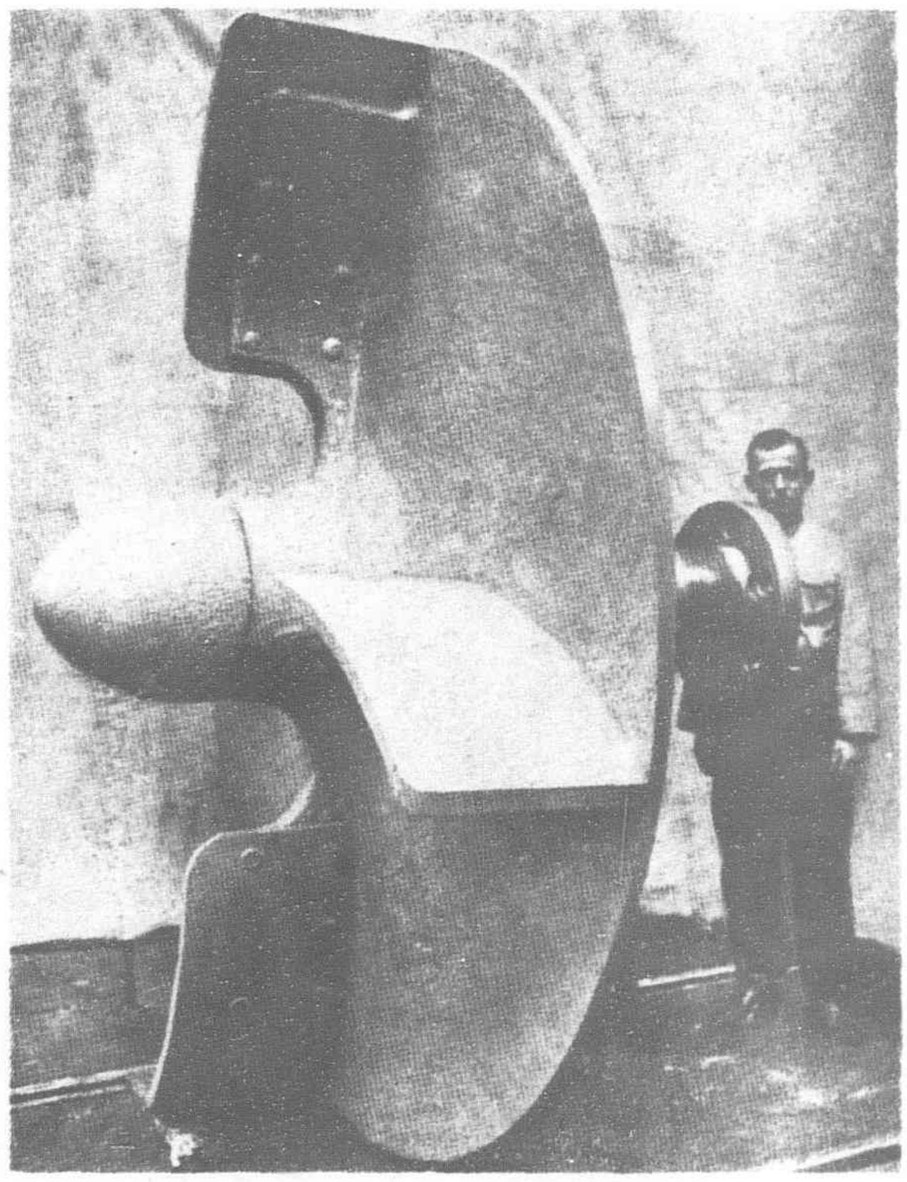


Fig. 14.—Dredging pump impeller

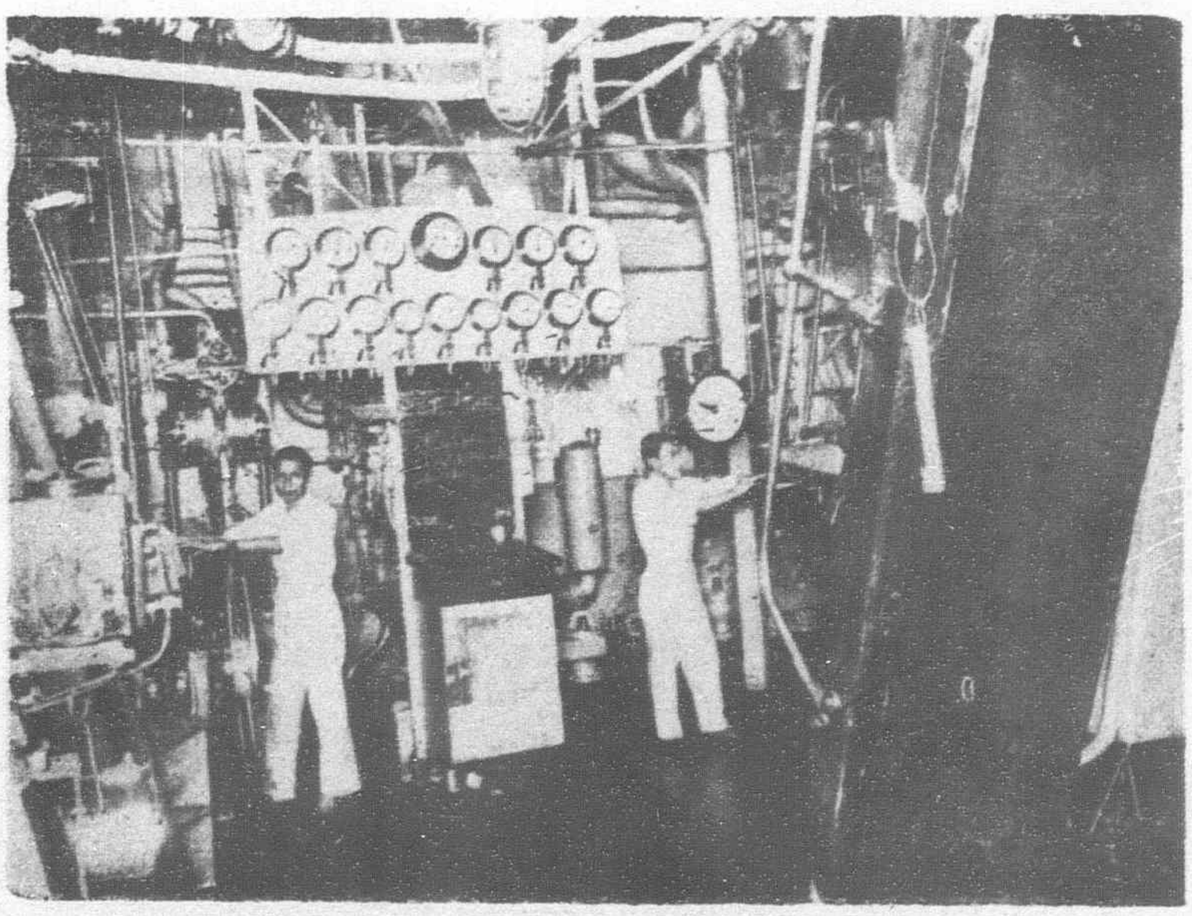


Fig. 20.—General view of the propelling engine room center

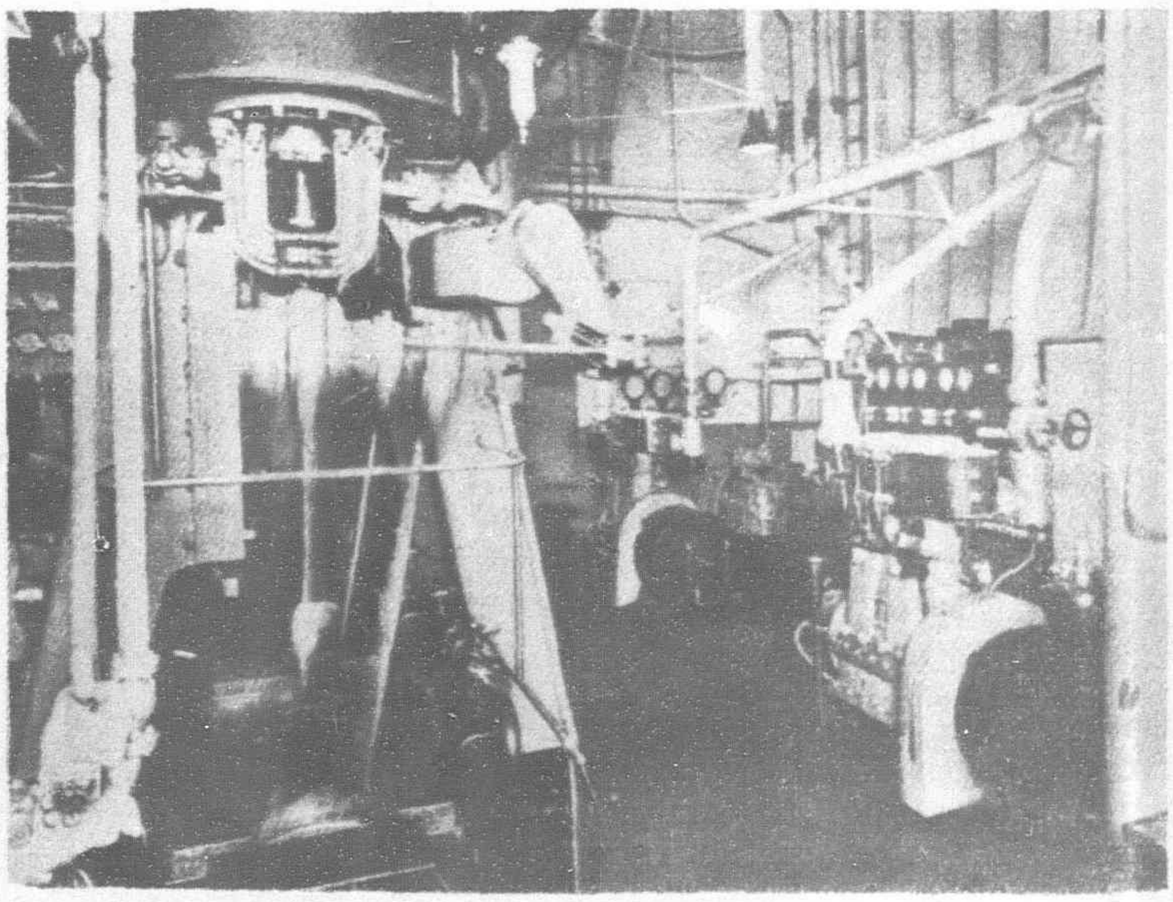
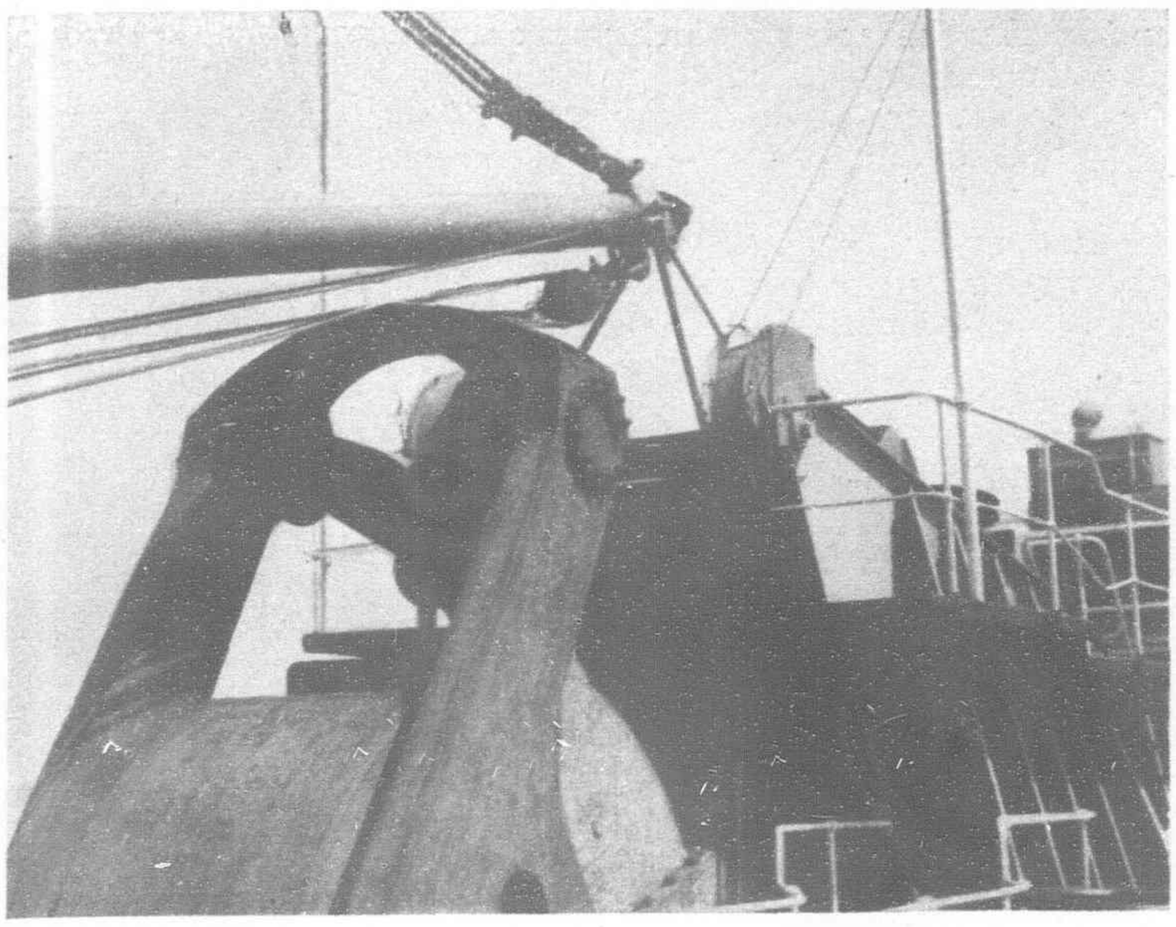


Fig. 21.—General view of the propelling engine room starboard



View of the upper portion of the drag suction apparatus

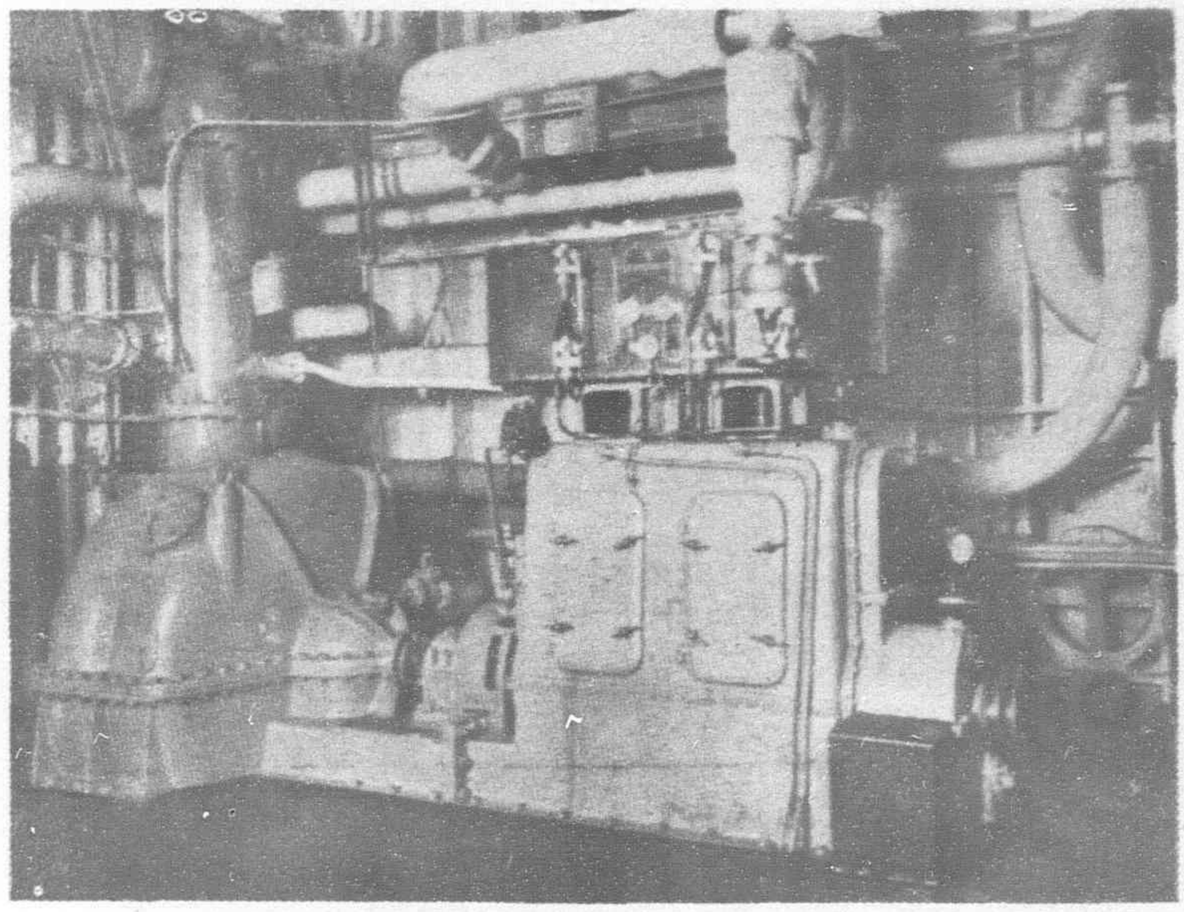


Fig. 15.—Flushing pump and engine

Particulars of the various suction and discharge connections are given on the following table :—

TABLE III.—PARTICULARS OF SUCTION AND DISCHARGE CONNECTIONS

Description	*Number*	*Dimensions* *Millimetre*	*Inches*
Maximum opening at entrance to 8-ft. draghead	—	2400 × 900	96″ × 35½″
Suction opening in draghead crown	1	1100 × 900	43⅜″ × 35½″
Section of Outboard suction pipe	1	1200 × 800	47¼″ × 31½″
		Diameter	
Main dredging pump suction	1	1100	43⅜″
Pump suction branches from hoppers	2	700	27½″
Pump suction from sea	2	300	11¾″
Mixing water sea valves	10	560	22″
Main dredging pump discharge	1	1000	39⅜″
Overboard discharge pipes	2	1000	39⅜″
Discharge pipes to hoppers	2	700	27½″
Discharge outlets to hoppers	10	450 × 586	17¾″ × 23″
Pressure water pump sea suction	1	450	17¾″
Pressure water pump discharge	1	400	15¾″
Pressure water connection to doors	1	100	4″
Clear openings in bottom for dumping	10	2060 × 2230	81″ × 88″

Independent sea inlets each fitted with hydraulically operated sluice valves are arranged, five on each side of the vessel, with short inlet pipes leading to the lower compartments of the hoppers. These inlets are placed directly opposite the suction openings from the hoppers and are used for diluting the hopper mixture when the load is being pumped overboard, from the hoppers.

A double stage centrifugal pump having both chambers working in series constructed by the builders, is installed in the pumping engine room for the supply of high pressure water to the draghead water jets and also to the bottom door frames for cleaning the joints after the spoil has been dumped. This unit is illustrated in Fig. 15.

The pump has a capacity of 2,500 gallons per minute against a head of 150-ft. or 6,000 gallons at 30-ft. head, and is driven direct by a set of vertical compound, enclosed type, engines developing 290 i.h.p. at 325 revs. per minute.

Two steam driven hydraulic pumps are also installed for providing the necessary high pressure water supply to the various hydraulic rams and sluice valves in connection with dredging equipment. The pumps are of the vertical duplex, long stroke type, arranged to work at a water pressure of 750 lbs. per square inch, the door rams being operated at about 600 lbs. per square inch and the individual sluice valves at a reduced pressure of 250 to 300 lbs. per square inch. The pumps are fitted with regulator controls on the steam and water ends of the system.

Pumping Machinery

The main dredging pump is driven direct by a single vertical triple expansion, marine type steam engine having cylinders 500 m/m.—820 m/m.—1,350 m/m. diameter respectively by 950 m/m. stroke (19$\frac{11}{16}$-in.-32¼-in.-51$\frac{3}{16}$-in. × 37⅜-in.) capable of developing 2,400 Indicated Horse Power at a normal speed of 150 revs. per minute.

The engine is of substantial construction, designed for a moderate degree of superheat, with crank shaft arranged in three

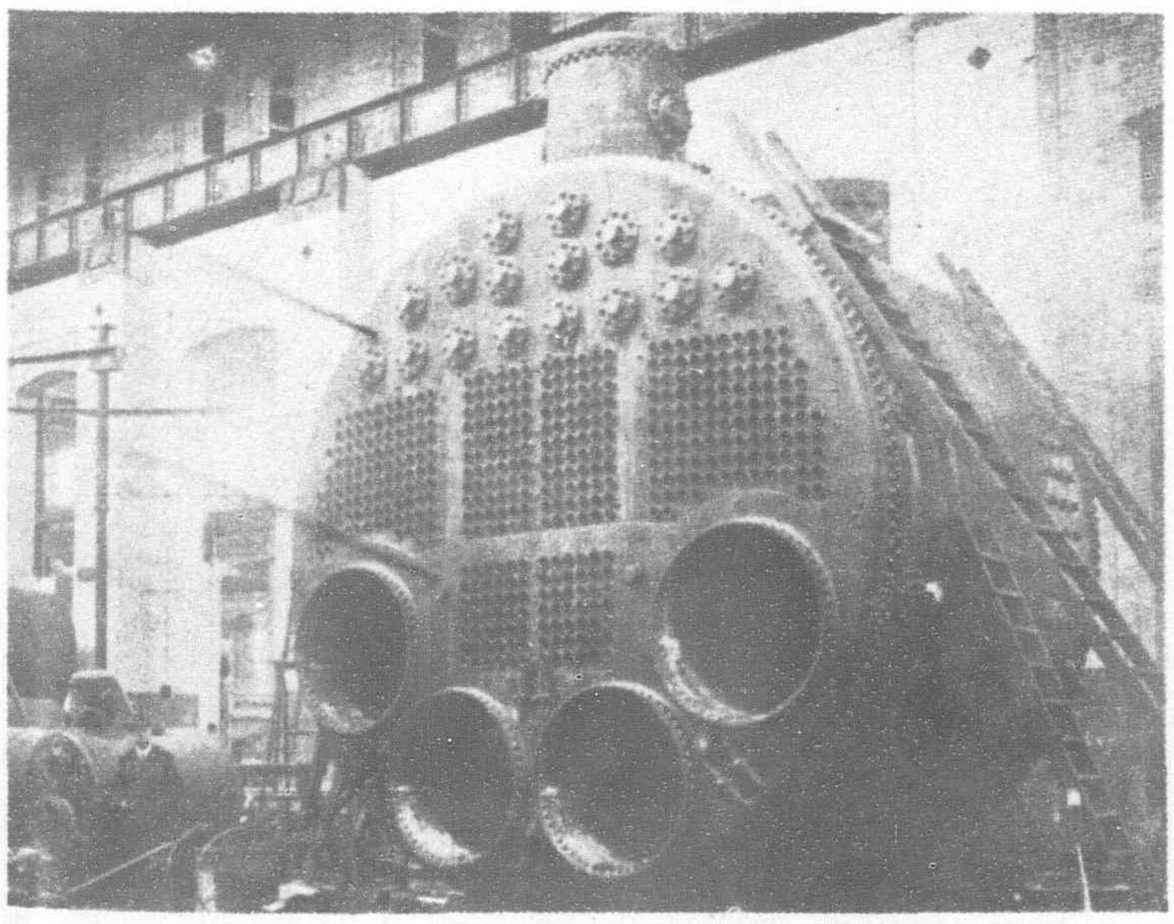


Fig. 22.—One of the four boilers under test

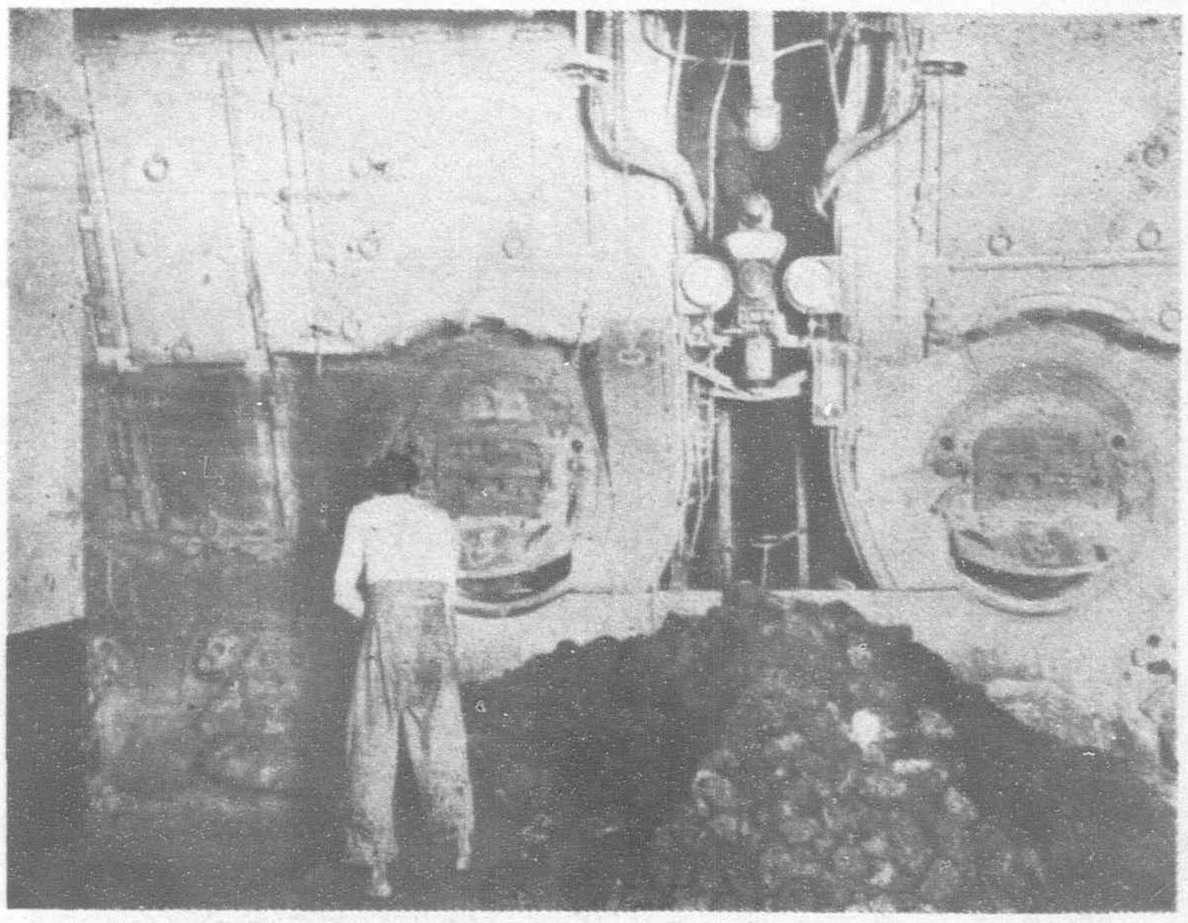


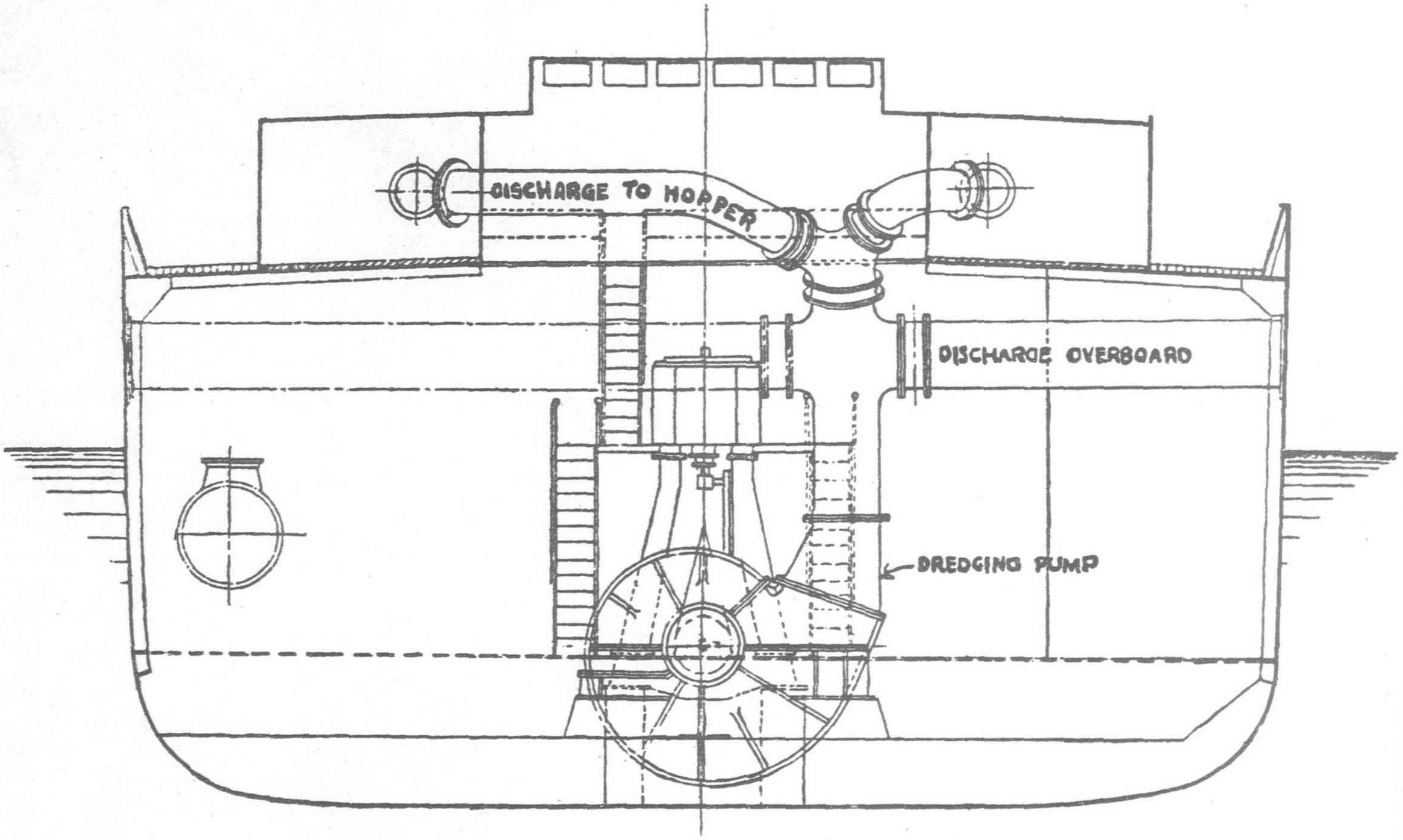
Fig. 23.—View of the after stokehold

interchangeable sections, ahead and astern valve motion and reversing gear, and fitted with a dead-weight sensitive governor. The Pistons are fitted with Lockwood and Carlisle packing rings, and the rods with patent metallic packing. The cylinders are well insulated and entirely enclosed by portable polished steel covers.

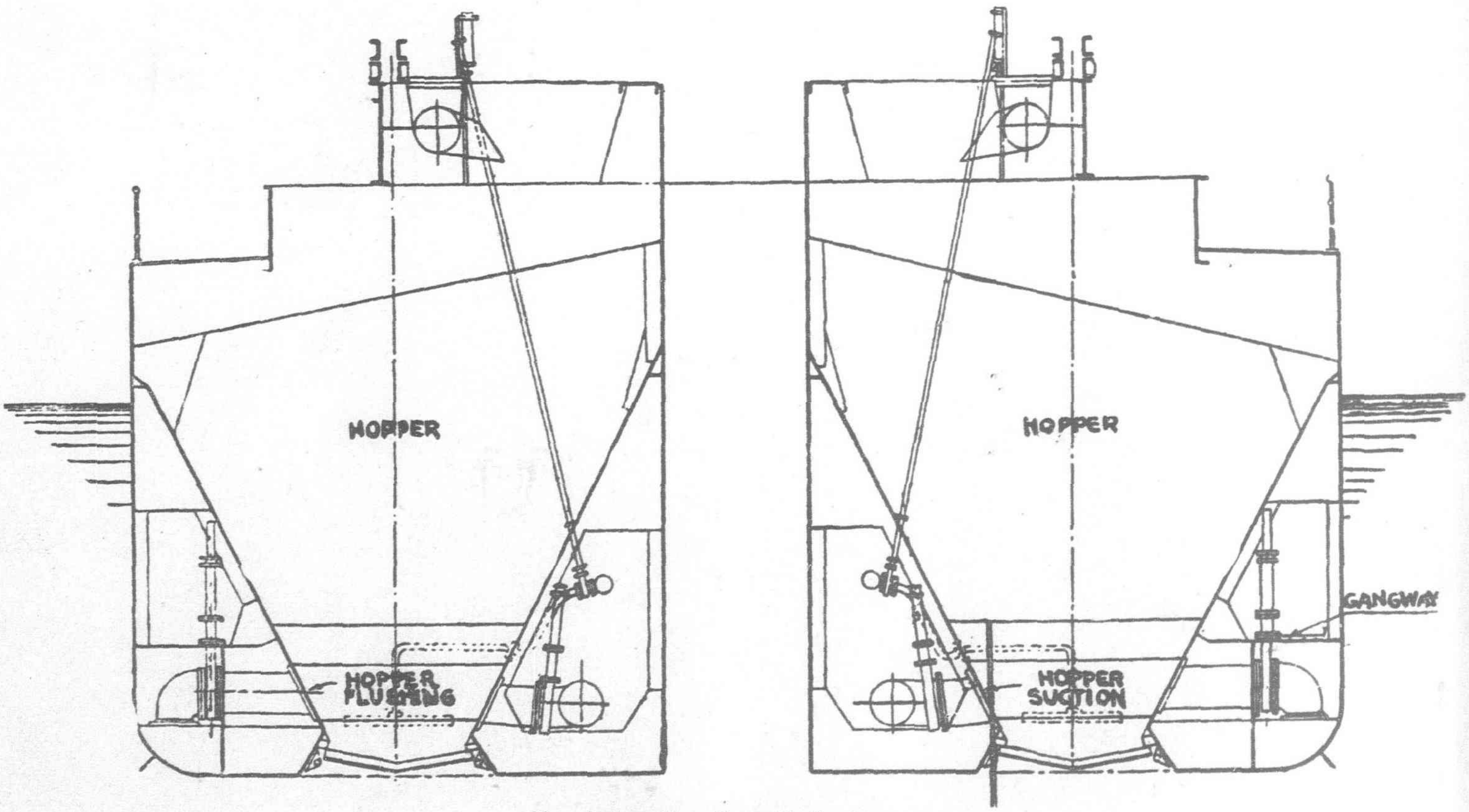
The pumping machinery which is installed in a separate engine room situated forward of the hopper spaces is entirely independent from the propelling machinery having its own condensing plant and auxiliary machinery which can be shut down when the dredging operations are suspended.

The pump room auxiliaries are all steam driven and comprise the following units :—

One Weir's Regenerative Condenser 3,200 square feet constructed by the Builders, a " Weirs " Paragon type air pump, a 12-in. centrifugal circulating pump, a duplex cylinder condensate pump with automatic control from filter tank ; bilge, ballast and



Section on frame showing details of dredging equipment



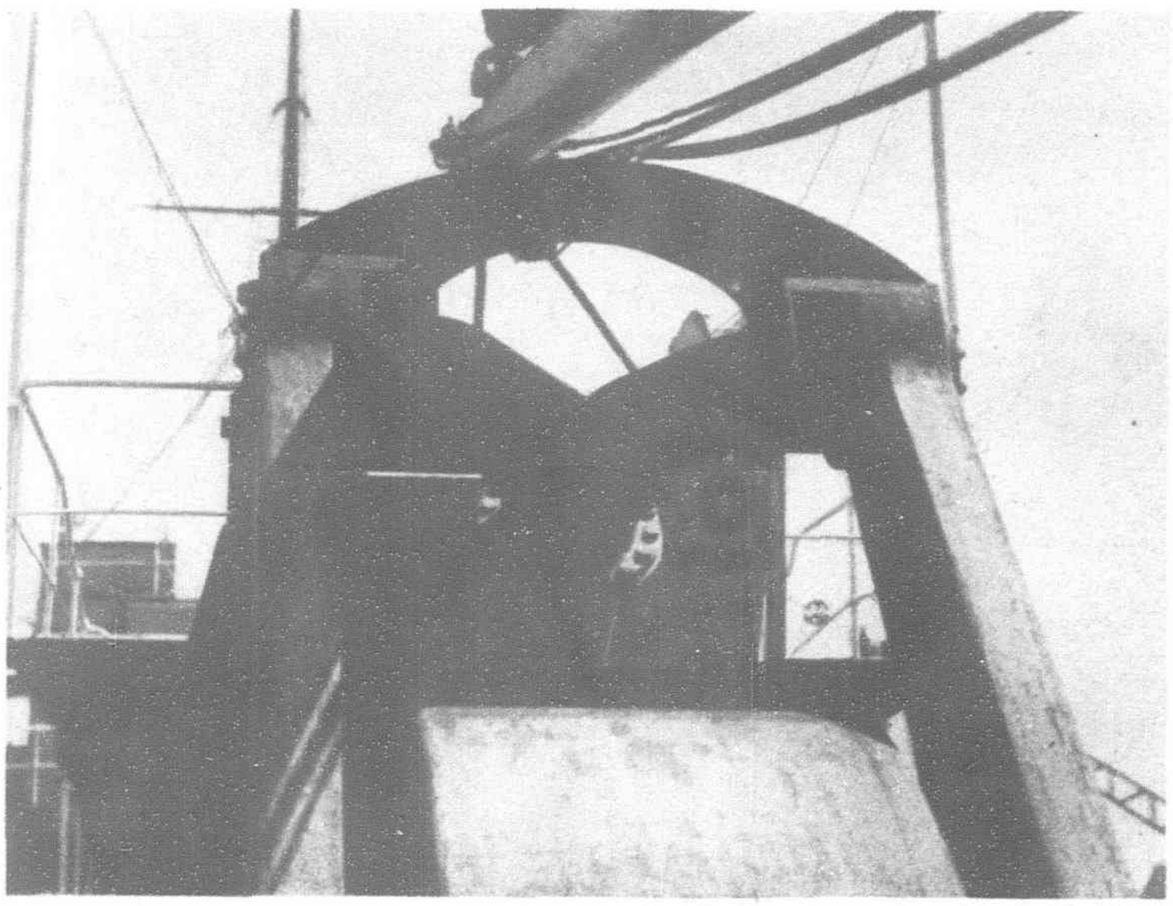
Showing section through the hoppers

gland pressure water pumps, and as already mentioned the large high pressure water jet pump and a pair of powerful duplex pumps for the hydraulic pressure system.

On the starboard side of the pump room a well equipped workshop is arranged in a separate enclosure over which is situated a spacious pump room store. A general view of the pumping machinery and dredging pump is shown in Figs. 16 and 17.

Propelling Machinery

The propelling machinery consists of twin sets of triple expansion surface condensing steam engines having cylinder 480—800—1,300 m/m. diameter by 750 m/m. stroke, ($18\frac{7}{8}$-in.-$31\frac{1}{2}$-in. $51\frac{3}{16}$-in. $\times$ $29\frac{1}{2}$-in.) capable of developing a total of 3,000 i.h.p. at a normal speed of 130 revs. per minute. The working parts



Another view of the draghead which will shift 30,000 tons of mud per day

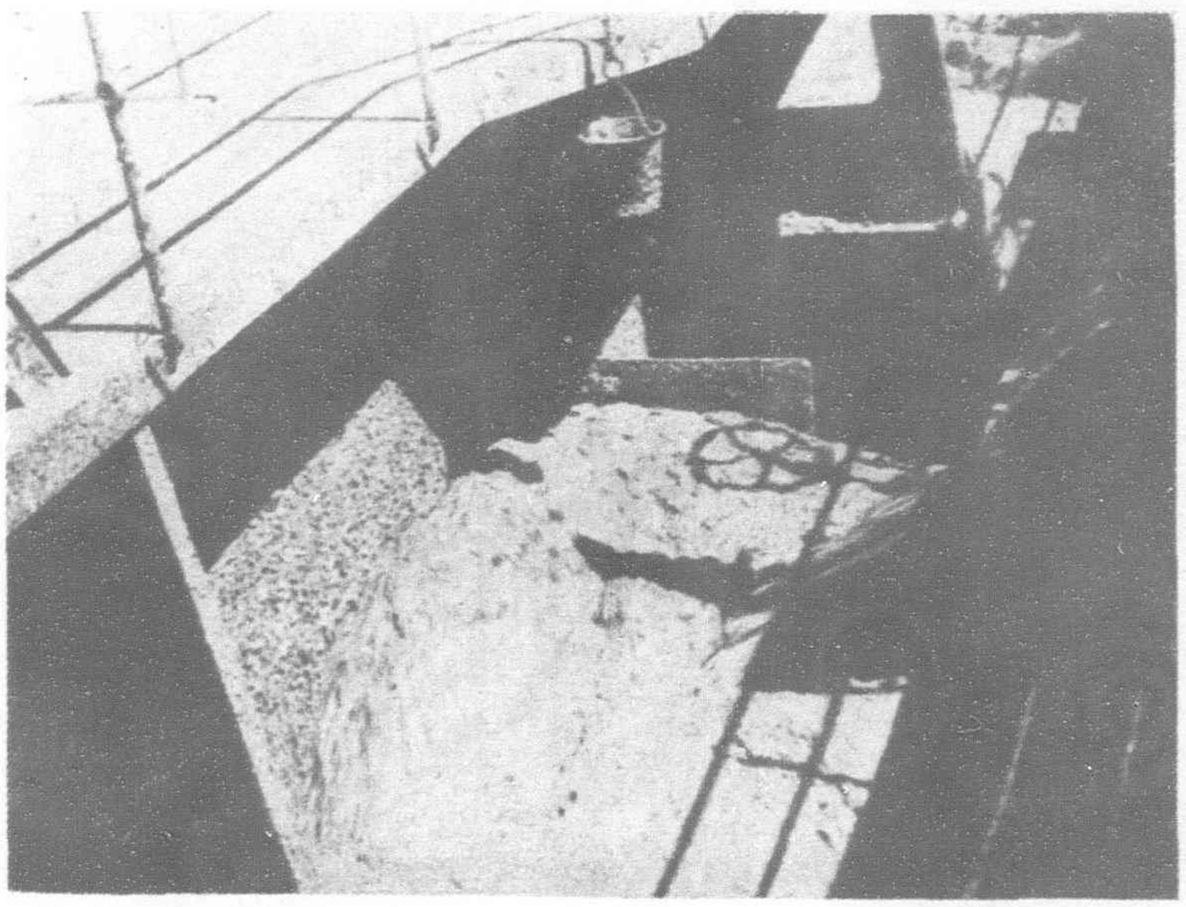


Fig. 39.—Filling mud to starboard hoppers through distributor outlets

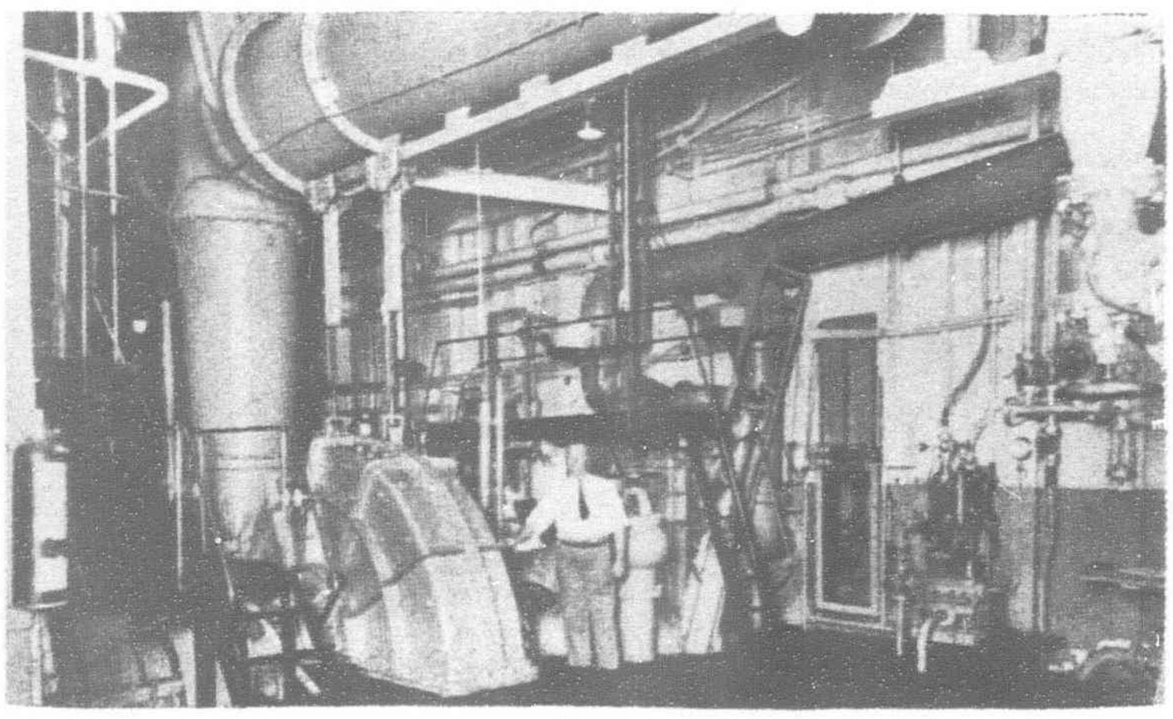


Fig. 17.—General view of the pumping engine room

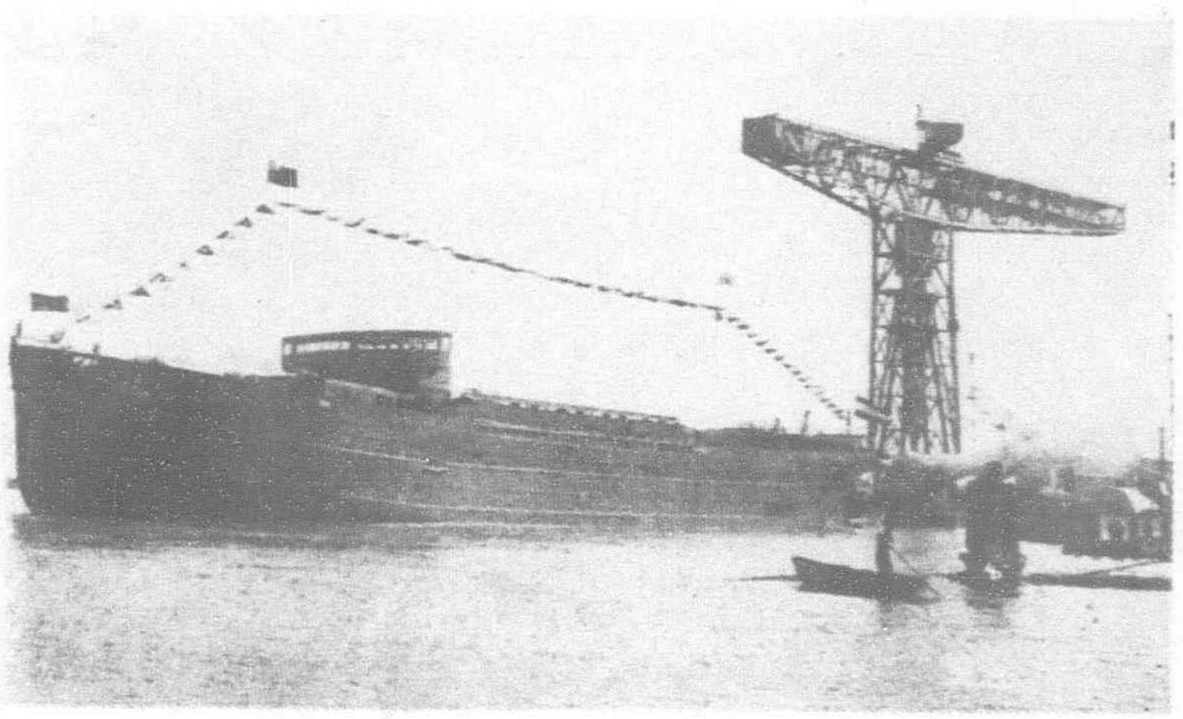


Fig. 30.—Dredger after launching 15/9/34

Fig. 29.—Dredger ready for launching 7/9/34

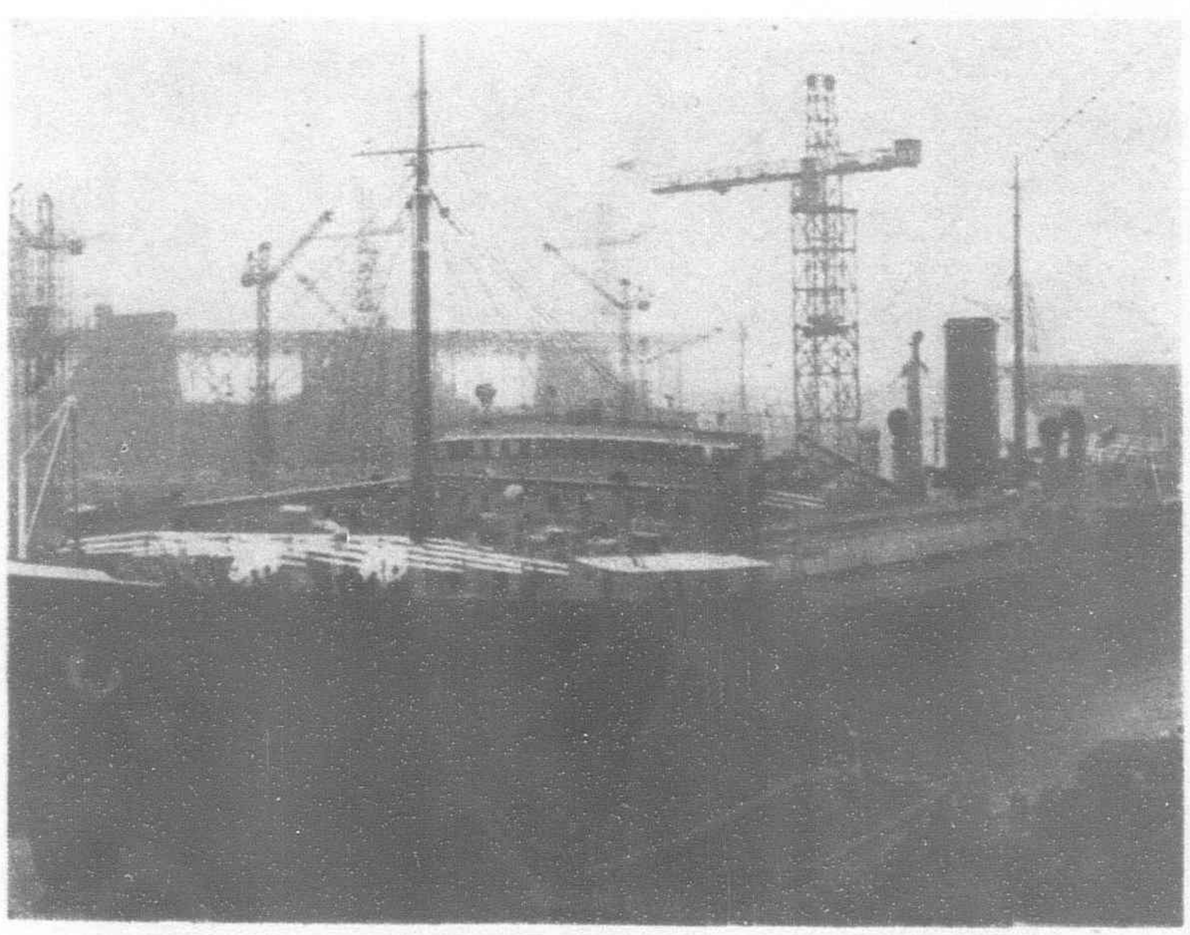


Fig. 31.—Dredger ready for trials 11/12/34

are designed for superheated steam. The engines are entirely independent for propelling purposes, with crank shafts in three interchangeable sections, fitted with "Michell" type patent thrust blocks, and driving four bladed cast iron propellers. All the pistons are fitted with Lockwood and Carlisle packing rings and the rods with patent metallic packing. The cylinders are well insulated and entirely enclosed on top with portable covers of planished steel sheets lined with asbestos material. The stern tube bushes are of cast iron fitted with Vicker's type sand excluding glands.

A large range of steam driven auxiliaries is provided for the feed water system and general service duties including:—One Weir's regenerative type condenser common to both engines having a cooling surface of 3,200 sq. feet, constructed by the Builders, Weirs Main and auxiliary feed pumps with automatic feed control, Weir's "Paragon" type Air pump, Weir's 10 ton Evaporator and fresh water distilling apparatus, 12-in. centrifugal circulating pump; and the usual Bilge, Ballast and General service pumps. In addition an independent auxiliary condensing equipment is provided for port and stand-by use comprising:—A Weir's type condenser, "Mono-type" Air pump, and a 6-in. centrifugal circulating pump. A general idea of the arrangement of the propelling engine room may be seen from Figs. 18 to 21.

The suction side of the feed water system connects to a gravitation type feed water filter of large capacity, into which the condensate water from the Pumping and Propelling engine room is directed together with drains from all the main and auxiliary machinery. The feed water passes from the filter by automatic control to the main feed pumps and is discharged through a Weirs "Multiflow" type surface feed water heater before entering the Boilers.

A No. 6 "Hall's" CO2 refrigerating machine is installed at the after end of the engine room adjoining the insulated chambers, while two vertical compound steam generating sets, supplied by the Builders, each driving a 16 k.w. Siemen's dynamo, together with a 12 k.w. "National,"—"Lawrence Scott" Emergency diesel dynamo set supplied by the National Gas and Oil Engine Co., Ltd., Ashton-under-Tyne, completes the auxiliary equipment in the propelling engine room.

Boiler Room Installation

The steam generating equipment consists of four single—ended, cylindrical return tubes, four furnace boilers each fitted with superheater and arranged for operating under Howden's system of forced draught in a common open stokehold, the furnace fronts being arranged for coal or oil fuel burning. The boilers, superheaters, and fan units have been supplied by the Builders from their works at Elbing, the furnace fronts by Messrs. James Howden & Sons Ltd., Glasgow and the oil fuel equipment by The Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne.

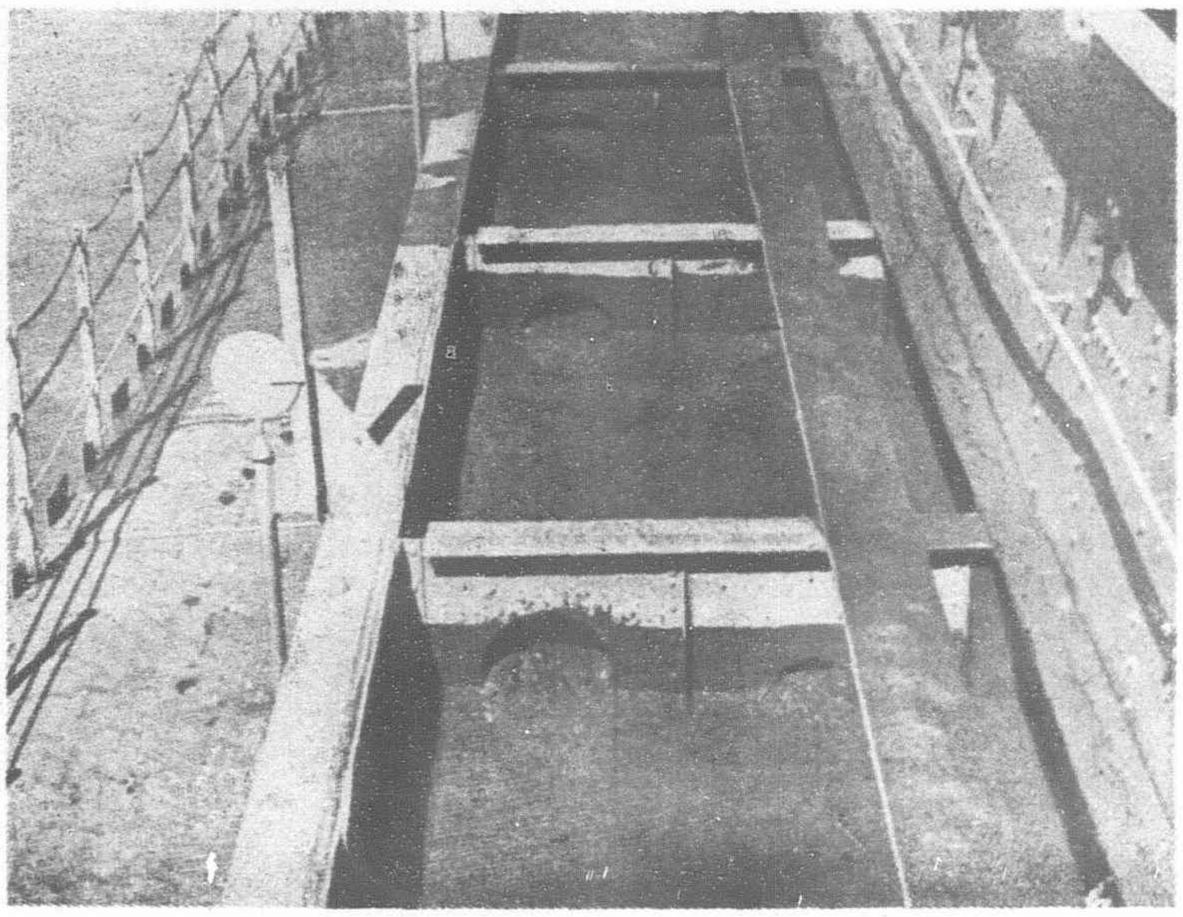


Fig. 40.—Hopper load of thick mud

The boilers are each 17-ft. 1-in. mean diameter × 12-ft.-11-in. mean length constructed with a single shell plate for a working pressure of 200 lbs. square inch, the steam being superheated to 610° F. in order to compensate for pressure drop in the long main steam range to the forward engine room. One of the four main boilers is shown under construction in Fig. 22 and a view of the after stokehold in Fig. 23.

The total heating surface of the four boilers is 13,760 sq. feet, the grate area 328 sq. feet and the superheater surface 540 sq. feet. Each pair of boilers is fitted with a "Ranarex" CO2 recorder, and two "See's" ash ejectors are installed for discharging the ashes. Soot blowing arrangements are fitted to each boiler. Under service conditions the Boilers are capable of supplying steam for all purposes, under natural draught condition when burning a good quality of Chinese coal having a calorific value of about 14,000 B.T. Us per pound.

Electrical Installation

The vessel is fitted throughout with electricity, the current being supplied from the steam generating sets installed in the propelling engine room. In addition to the deck and accommodation lights four powerful flood lights are fitted on posts over the dredging well for working at night, also a 6,000 Watt searchlight is installed and arranged for working from the navigating bridge.

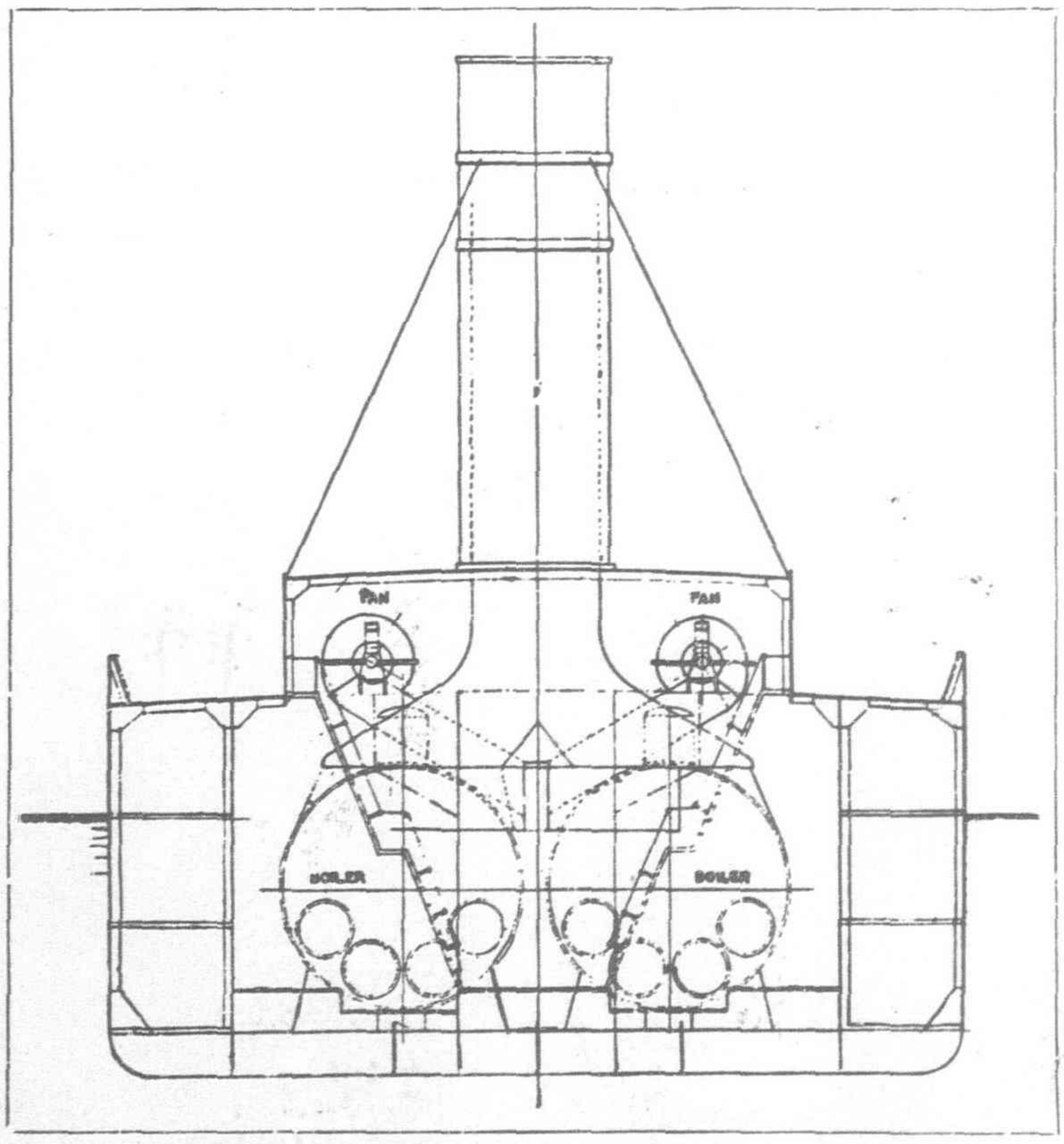
The main switch board is composed of polished "Sindanyo" panels built on a steel framework and arranged with the usual light and power circuits, switches and cut-outs. The instruments and fittings are of Siemen's make.

Trials and Delivery

The keel of the *Chien She* was laid in the Danzig Yard of the Builders on March 1, 1934 and on September 15, the vessel was successfully launched by Madame Liu Chung Chieh, wife of His Excellency the Chinese Minister at Berlin. Photographs 24 to 33 serve to indicate the very satisfactory progress made during construction.

Before leaving on the voyage to Shanghai the dredger carried out a series of preliminary dredging and speed trials at Pillau at the entrance to the Koenigsberg Canal, in mid January, under unusually severe cold weather conditions.

The *Chien She* arrived at Shanghai on April 14, 1935, and after docking for adjustment of the hopper doors and re-assembling of the dredging equipment, the vessel was put into service condition and proceeded on official trials commencing on May 8, 1935. The trials prescribed in the Board's agreements with the Builders were of a full and exhaustive nature covering a period of 100 hours dredging at the Tungsha Bar in the Yangtsze Estuary, Speed trials, Endurance trials, and Coal and Oil fuel consumption trials.



Section through boiler room of the dredger

These were successfully completed within 10 days of the commencement, the vessel showing a highly satisfactory performance on all trials, as may be seen from the record of results in Tables. IV and V.

TABLE IV.—SUMMARY OF RESULTS OF OFFICIAL TRIALS

Dredging Output in cubic yards, in-situ mud, per 10 hours dredging, including transport to dumping area	25,000 cub. yards	26,507 cub. yards
Coal consumption, dredging ..	2.1 lbs. per i.h.p.	1.77 lbs. per i.h.p.
Speed fully loaded	10.25 knots	11.188 knots
Speed in light condition	—	11.632 knots
Endurance trial, six hours steaming	Easy steaming at 10.25 knots	Satisfactory
Coal consumption steaming at 10.25 knots	—	1.98 lbs. per i.h.p.
Oil fuel consumption, dredging ..	—	1.104 lbs. per i.h.p.
Oil fuel consumption, steaming ..	—	1.293 lbs. per i.h.p.

TABLE V.—SUMMARY OF RESULTS OF PROGRESSIVE SPEED TRIALS

Speed Trials Loaded				*Speed Trials Light*			
Draft 18′-0″—Displacement 8,400 tons				Draft 11′-7″—Displacement 5,220 tons			
Run	Revs.	Speed knots	I.H.P.	Run	Revs.	Speed knots	I.H.P.
A	70	5.538	495	A	80	7.061	735
B	90	7.705	1087	B	100	8.806	1395
C	100	8.249	1415	C	120	10.752	2428
D	120	9.652	2268	D	135	11.632	3365
E	131						
F	131	11.188	3293				
G	131						

Speeds given are mean of means of runs with and against the tide.

The Dredger *Chien She* was officially accepted by the Board as from July 3, 1935 and thereafter was commissioned for service commencing regular dredging operations at the Tungsha Bar on July 8, 1935.

Progress of the Dredging Operations at the Yangtsze Bar

It was clearly demonstrated by the satisfactory performance of the Dredger *Chien She* on the official trials and preliminary dredging operations at the bar that the Whangpoo Conservancy Board has been particularly fortunate in the choice of this type of dredger for the important undertaking of dredging the Yangtsze Bar.

The mud, clay and sand materials comprising the bar can be readily excavated, and further the centre-well disposition of the Draghead which has been incorporated in the design has proved eminently suitable for the tidal and weather conditions at the dredging site, the dredger *Chien She* being exceptionally easy to manoeuver in the prevailing cross currents when dredging at a speed of about three knots over the ground.

During the period the *Chien She* has been on service up until the end of July 1936, a quantity of 4,296,110 cubic yards of material has been dredged from the crest of the Bar, and deposited on the dumping area about two miles distant from the dredging cut, in a total time of 2,271 working hours, resulting in a deepening of the channel of about three feet over a width of 600 feet and a distance of three miles.

This remarkable achievement is considered highly satisfactory in view of the fact that over 60 per cent of the output consisted of hard sand which is not only difficult to dredge but quickly settles in the mixture resulting in a low average hopper density.

The photographs shown in Figs. 34 to 40 illustrate some interesting details of the dredger and the working operations, particularly Fig. 40 which shows a hopper load of thick mud having a mixture density of over 1.5 sp. gravity, dredged from the Yangtsze Bar.

TABLE VI.—PARTICULARS OF THE FIVE LARGEST DREDGERS

Name of Dredger	*Leviathan*	*Chien Shee*	*Pierre Lefort*	*M.O.P.217c*	*"Rietbok"*
Year Built	*1909*	*1935*	*1934*	*1929*	*1930*
Builders	Cammel	Schichau	Deschimag	Werf Gusto	Simons
Length B. P. ..	465′-9″	360′-0″	337′-0″	325′-0″	374′-0″
Beam Moulded ..	69′-0″	60′-0″	54′-0″	52′-6″	57′-9″
Depth Moulded ..	30′-7″	26′-6″	26′-0″	23′-0″	25′-9″
Designed loaded draft	23′-0″	18′-0″	19′-0″	18′-0″	18′-0″
Material designed for	Sand	Firm Mud	Various	Light Mud	Sand
Type of Dredger ..	Moored Suction Flexible head	Drag Suction Scooping head	Trailing Suction flexible head	Drag Suction Scooping head	Moored Suction Flexible head
Hopper Capy, to Deck Level cub. yds.	6700	3700	2610	2610	3700
Dredging rate in cub. yds. hour ..	8000	Normal. 8000	3300	8000 Contract (14000 Trials)	4000
Number and size of Suction pipes ..	4 @ 42″	1 @ 43″	2 @ 25½″	1 @ 37″	1 @ 42″
I.H.P. of Pumping Engines	2800	2400	2000	2000	1350
I.H.P. of Propelling Engines	4000	3000	3000	2000	3000
Total I.H.P. of main Machinery ..	6800	5400	5000	4000	4350
Type of Machinery .	Steam	Steam	Diesel Electric	Steam	Steam
Speed in knots, loaded	10.5	11.0	11.0	9.0	11.5
Maximum Dredging Depth in ft. ..	70′	45′	65′	50′	No inform
Location of service ..	Mersey Bar	Yangtsze Bar	Bordeaux Bar	Punto Indio	Durban Bar

The above table gives the principal characteristics of five of the largest Bar dredgers now in operation, from which it will be seen that the Dredger *Chien She* is the largest and most powerful of the Drag Suction type which has yet been constructed.

FOUR BIG CONTRACTS FOR BRITISH FIRMS

An agreement involving the purchase by China of £900,000 worth of British railway material has been initialled by Messrs. Jardine Engineering Corporation, Ltd., and the Nanking Ministry of Railways. The material will be used to equip the new Kingkan line, which is to link Nanking with the Canton-Hankow Railway. The transaction is being financed jointly by the Hongkong and Shanghai Banking Corporation and the British Boxer Indemnity trustees, and the equipment will be purchased through Messrs. Jardine Engineering Corporation, Ltd.

Details are now available of two big contracts awarded to British firms by the Canton Municipality. These total approximately $5,450,000, of which $2,250,000 goes to Messrs. Malcolm & Co., for the extension and improvement of the Canton waterworks and distribution system, and the remainder, $3,200,000, to the General Electric Company of China for Canton's new trolley-bus scheme. In the contract awarded to the General Electric Co., the Municipality agree to purchase the whole of the electrical and mechanical plant required for the first section of the trolley bus scheme, including 64 bus chassis complete with all electrical equipment, as well as compressed air braking equipment, over-head apparatus for 18⅓ miles of double-track and for two car-sheds to hold 40 vehicles each, a number of sub-stations, 8½ miles of underground feeder cable and other equipment. The company has agreed to give the Municipality credit extending over a period of six years. The trolley project is a part of the program to improve the city's communications, which are at present in deplorable shape. The contract awarded to Malcolm & Co., provides for the installation of a new waterworks system, the total cost of which will be about £81,000, and of the loan to cover it, about 1,400,000 Hongkong dollars. The loan is for a period of six years. A Sinking Fund Committee of five members will be established to receive the surplus revenues from the waterworks and allocate them for the service of this loan.

Messrs. Inniss & Riddle (China), Ltd., the B.T.H. China Agents, state that the Hongkong Electric Co., placed an order with The British Thomson-Houston Co., Ltd., Rugby, for a 15,000 kw. turbo generating set. This generator will be the largest in Hongkong and South China and the fourteenth B.T.H. turbo set supplied to Hongkong. The largest and most efficient electric generating set in China is to-day the 22,500 kw. B.T.H. set at Riverside Station of the Shanghai Power Company.

Manchuria's Mineral Resources*

MANCHURIA possesses valuable mineral resources, in quantity and quality adequate for the development of large-scale modern industries. Among all the provinces of the former Chinese empire Manchuria has, next to Kiangsu, the best possibility for industrial development. The Russians were the first to exploit with modern machinery the mineral riches of the country, but they were soon superseded by the Japanese, who are responsible for the important industrial enterprises established there so far. Following the recent sale of the erstwhile Chinese Eastern Railway to Manchoukuo, the Japanese have eliminated the Russians from the industrial sphere of Manchuria.

The most important minerals of Manchuria, with their estimated total deposits in metric tons, are as follow :

Coal	4,800,000,000
Iron ore	400,000,000
Gold	3,700
Oil shale	5,400,000,000
Magnesia	384,000,000

Besides these there are considerable deposits of copper, silver, lead, steatite and limestone along with sundry minerals of lesser importance. In the following the more prominent mineral riches, with the state of their current utilization, will be presented.

Iron

Iron and coal are the most useful and vital treasures underground. Practically all iron ore of Manchuria is located in its southern part. According to Chinese calculations ore deposit total 800 million tons, of which the greater portion cannot be utilized. A later Japanese estimate places total deposits at about 400 million tons, containing from 34 to 70 per cent of iron. The bulk of the deposits assays from 35 to 40 per cent. A series of Manchurian iron works with primitive equipment but sufficient to meet the small demand for iron in their respective districts in the eastern part of Fengtien Province, were erected in the olden days.

The main iron belts of Manchuria lie along the Mukden-Dairen and Mukden-Antung sections of the S.M.R. system, centering around Anshan and Penhsihu. The Anshan district deposits are the most important. These spread in a semi-circle with a radius of 15 kilometers with Anshan as the center. There stands the greatest iron works in all Manchuria, the Showa Iron and Steel Works, being one of the greatest and most modern equipped steel works in the world. More than 80 per cent of all the iron output in the country is there produced. Up to 1933 the Showa concern was a subsidiary of the S.M.R., becoming in that year an independent corporation with a capital of 100 million yen.

An expansion plan for the Showa Works was completed by July 1, 1925, when new installations for utilizing all the by-products of iron started operation. At present, the annual production capacity of the works is 450,000 tons of pig iron, 400,000 tons of steel, 8,300 tons of ammonia sulphate, 28,000 tons of tar, 4,500 tons of benzol, 1,000 tons of naphthalene and 11,000 tons of sulphuric acid. A special concentration process made it possible to utilize profitably the otherwise poor ores of the Anshan deposit. The number of Showa workers on July 1, 1935, totalled 14,779. The company now owns its own railway tracks totalling 148 kilometers and an electric station of 25,000 kilowatts.

In November, 1935, the Sumitomo corporation of Japan completed at Anshan a well-equipped factory for producing iron pipes and fittings, with an annual output of 25,000 tons. The products are partly marketed in Manchuria and partly exported.

The pig iron production of the Showa Iron Works in the past few years was as follows (in metric tons) :

Year	*Annual production*	*Average daily output*
1927	203,445	555.9
1929	210,443	577.0
1931	269,494	736.3
1932	197,124	786.6
1933	317,573	870.0

Similar data on the annual production of the by-products of the Iron Works follows (in metric tons) :

Producing capacity		*1929*	*1930*	*1931*
Sulphuric acid ..	7,600	5,466	7,629	7,150
Ammonia Sulphate ..	6,000	4,016	5,691	5,441
Naphthalene.. ..	600	400	332	430
Benzol	3,500	2,263	2,619	2,560

The iron works at Penhsihu are built on a smaller scale. Neglected for some years, the Penhsihu establishment was revived and enlarged in 1935 by the Okura corporation. It is expected that the iron works will be further expanded in future.

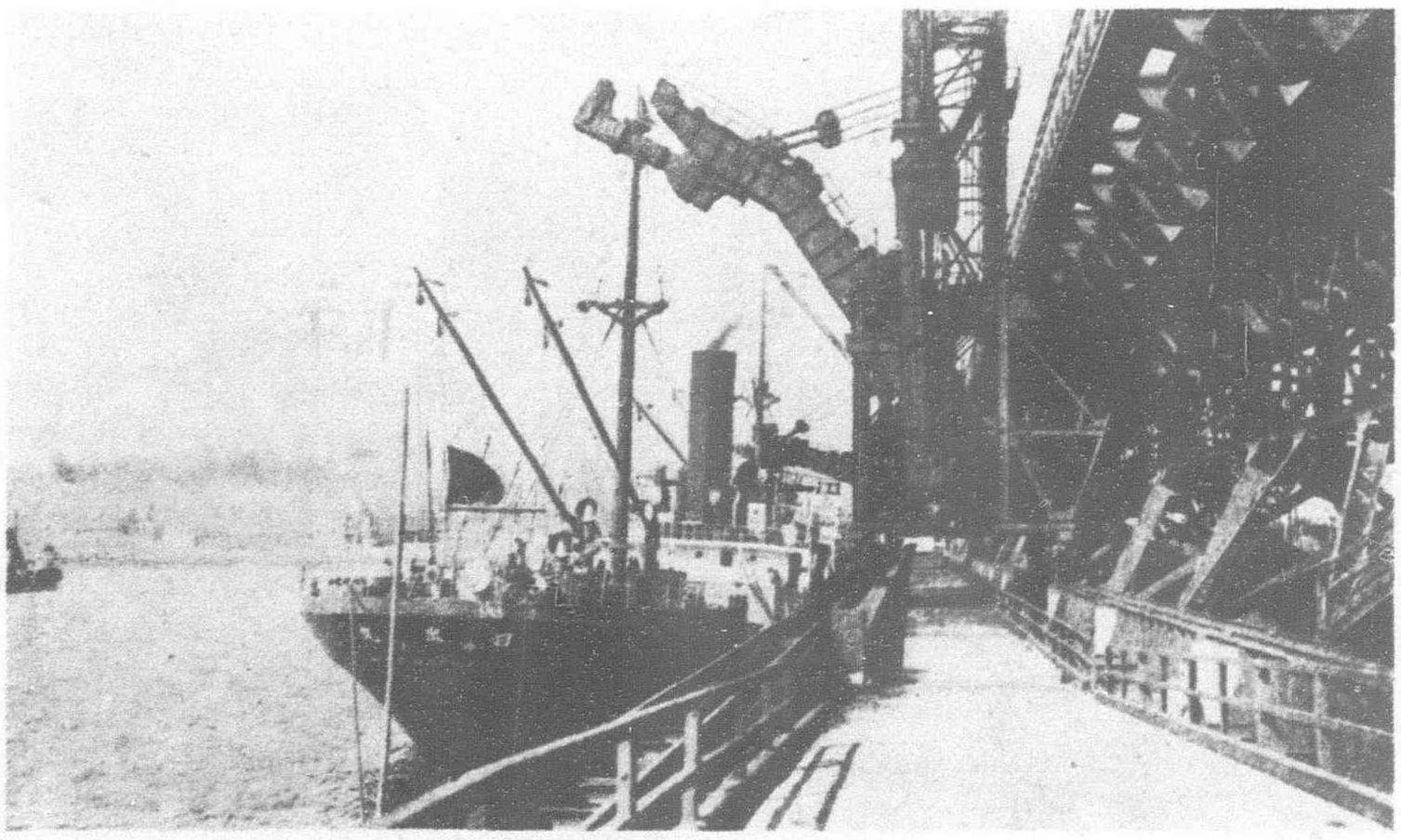
The pig iron output at Penhsihu in recent years was as follows (in metric tons) :

1927	50,500
1929	76,300
1931	65,620
1932	81,057
1933	115,950

The leading market for Manchurian pig iron is Japan, which imports nearly 75 per cent of the total sent out of the country.

Pig iron exports of the whole country were as follows :

Year	*Japan*	*Chinese ports*	*Others*	*Total*
1929 ..	204,759	24,145	605	229,509
1931 ..	245,732	38,771	2,184	289,693
1932 ..	332,632	30,994	5,608	368,694



The New Coal Pier, Kanseichi.

Gold

The most precious metal mined in Manchuria is gold and Dr. Annelt estimated the total gold deposits of Manchuria at 3,779 metric tons. It is found in form of placer gold, but is also inbedded among the upland rocks to a considerable quantity. The following 12 gold fields have been worked out so far: Sachiatun in the Humaho district, Moho, Chierhchen along the Amur, and the Kellari-Gan, Little Hsingan,

*Der Osteuropa Markt, Koenigsberg, Germany.

upper Sungari districts, the Tumenkiang area, the stretches along the Mutankiang, Mulinho rivers and the Sangsin district. Gold mining is now a state monopoly, to be operated by specially chartered companies. The market price of gold is fixed by the Government, being 3.50 yuan per gramme at present.

In May, 1934, the Manchuria Gold Mining Company was formed with a capital of 12 million yen, and it has been active ever since in developing existing gold fields and prospecting for new ones. The annual gold output of Manchuria varies. In 1931 it was valued at Y.29,900,000, in 1935 about Y.27,000,000. In the latest period the mining was mainly concentrated near Moho on the upper Amur. Within six months about 502 kilograms of gold were mined there.

Copper, Silver

Manchuria's resources in copper, silver and lead is not very extensive. Five fair-sized copper mines are located at Tienpaoshan in the Chientao Province, Panshih in the Kirin province, at Tungkuangling south-west of Antung, Malukou east of Penhsihu, and at Panling. The deposits of the Panling mine are estimated at 27,000 tons. Iron is mixed with the copper ore to the proportion of 14 per cent. The Tienpaoshan deposits are larger.

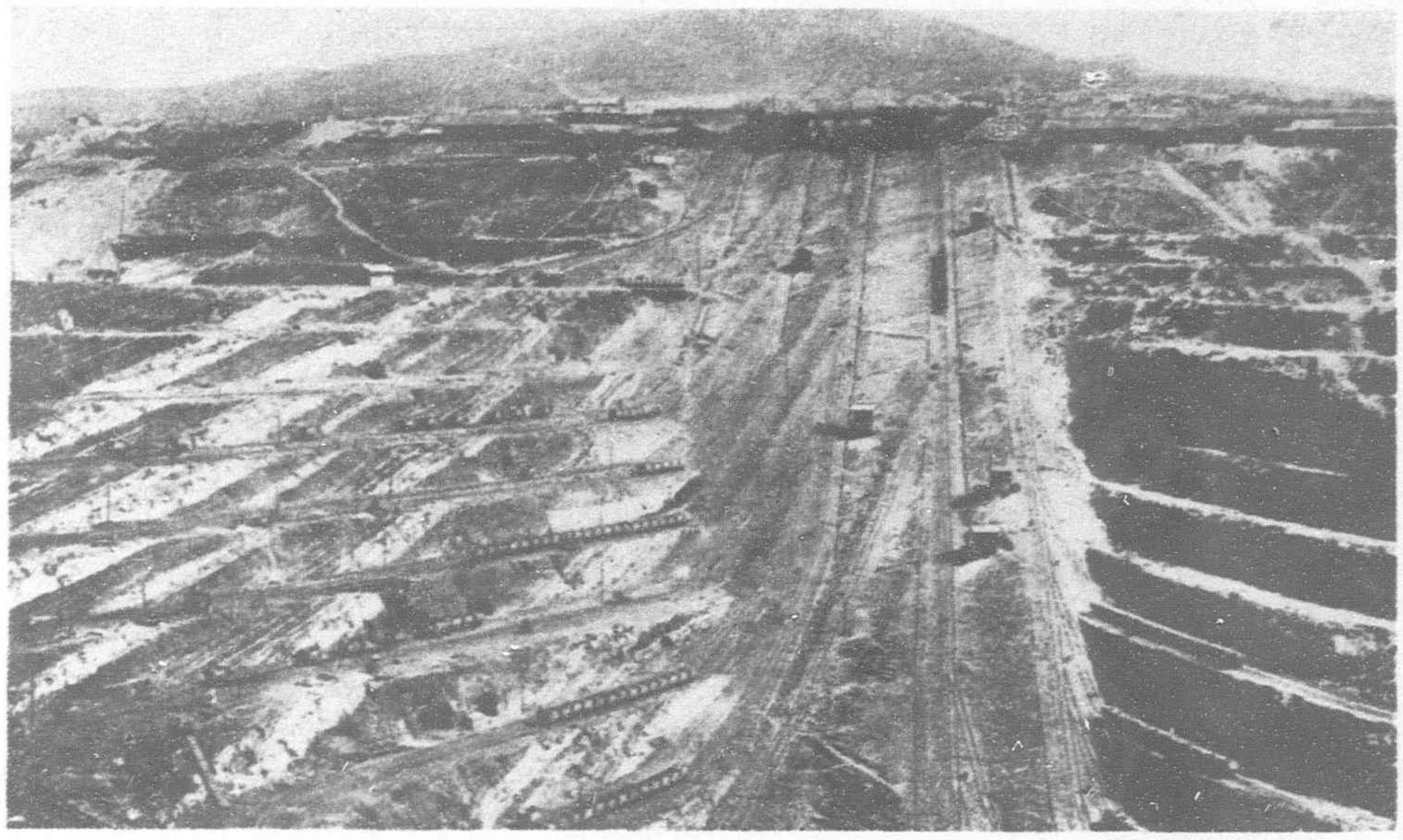
Silver, lead and zinc deposits have been found in sundry localities, but they have not been thoroughly investigated and exploited. The most important lead deposits are near Chingchengtzu in Fengtien Province, estimated to contain 51,000 tons. The metallic content is fairly high. In 1924 the Chingchengtzu mine yielded 2,600 tons of iron and 950 tons of lead.

Coal

Coal is the most important mineral of Manchuria. According to a thorough-going survey of the existing mines, in 1934, total deposits are 4,804 million tons. But there are besides a number of other sites possessing coal veins, where no mining operation has been commenced. The existing coal mines, with their estimated contents and provinces (according to old designations) they are located in, are as follows :

(In million metric tons) :

Fengtien Province	1,668
Fushun coalfield	950
Yentai ,, ...	40
Penhsihu ,, ...	220
Takotan ,, ...	111
Other fields	348
Kirin Province	1,030
Mishan	25
Muling	75
Other fields	55
Heilungkiang Province	197
Haolikang	144
Other fields	53
Hsingan Province	358
Chalainor	300
Other fields	58
Jehol Province	1,551
Hsinchiu	1,100
Nuantitang	12
Peipiao	250
Other fields	189
Grand total	4,804



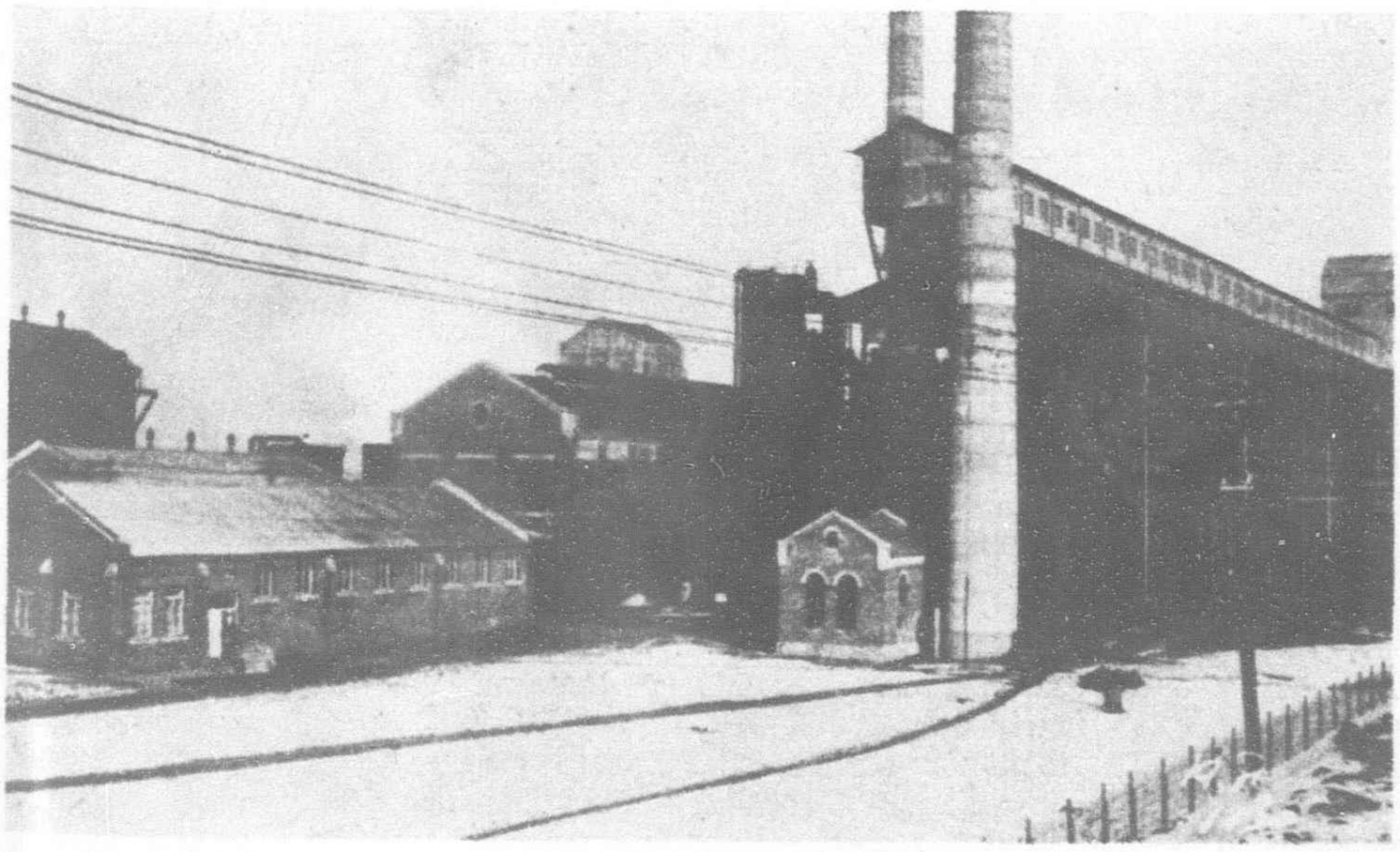
The Open-cut Mining, S.M.R. Fushun Collieries

The oldest and best developed coalfield of Manchuria is situated at Fushun. More than 600 years ago Koreans mined coal there in a primitive way. Then the Russians came, followed by the Japanese. The latter have been mining coal there for the past 30 years on a grand scale, employing the most up-to-date machinery for the purpose.

The center of the Fushun colliery is the town of Fushun, situated 36 kilometers east of Mukden, in the valley of the Hunho. The coal deposits extend to both sides of a Hunho tributary, being ten kilometers in length and two kilometers and a half in width. The depth of the coal seam varies between 40 and 130 meters. About half of the total output is taken from open-cut mines. Before the Manchurian Incident in 1931 employees there numbered about 60,000, of whom 5,000 were Japanese. Since then the number of Japanese has increased to 7,000.

The average daily output of a Fushun miner in 1931 was 0.45 tons, which rose by 1935 to 0.65 ton. Before January, 1912, only four million tons were mined from there ; between 1912 and 1931 inclusive, 78 million tons were mined. So that 870 million tons are still left of the Fushun deposits.

The current coal production at Fushun amounts to 85 per cent of Fengtien Province and 70 per cent of the whole of Manchuria. A large portion is exported. In 1920 about 26.4 per cent of the total output was shipped abroad ; in the fiscal year of 1926-27 about 46.6 per cent, and in 1930-31 nearly 50.2 per cent. Of the remainder the S.M.R. used 40 per cent : 20 per cent was consumed as bunker coal by ships, and the rest sold on the open market. The demand for Fushun coal is steadily rising, and its production capacity is now ten million tons a year.



The S.M.R. Shale Oil Plant

The Yentai colliery, with a deposit of 40 million tons, is situated 14 kilometers east of the Yentai station on the S.M.R. line, with which it is connected by a branch railway. The coal there is semi-anthracite, containing 71.2 per cent coke. There are 18 pits in the coalfield, and its annual output had risen by the fiscal year of 1931-32 to 187,000 tons.

The Penhsihu field with total deposits of 220 million tons is located on the Mukden-Antung line. Its coal is largely used in the iron works at Anshan, being suited for open-hearth furnaces. Recent annual production is around half a million tons.

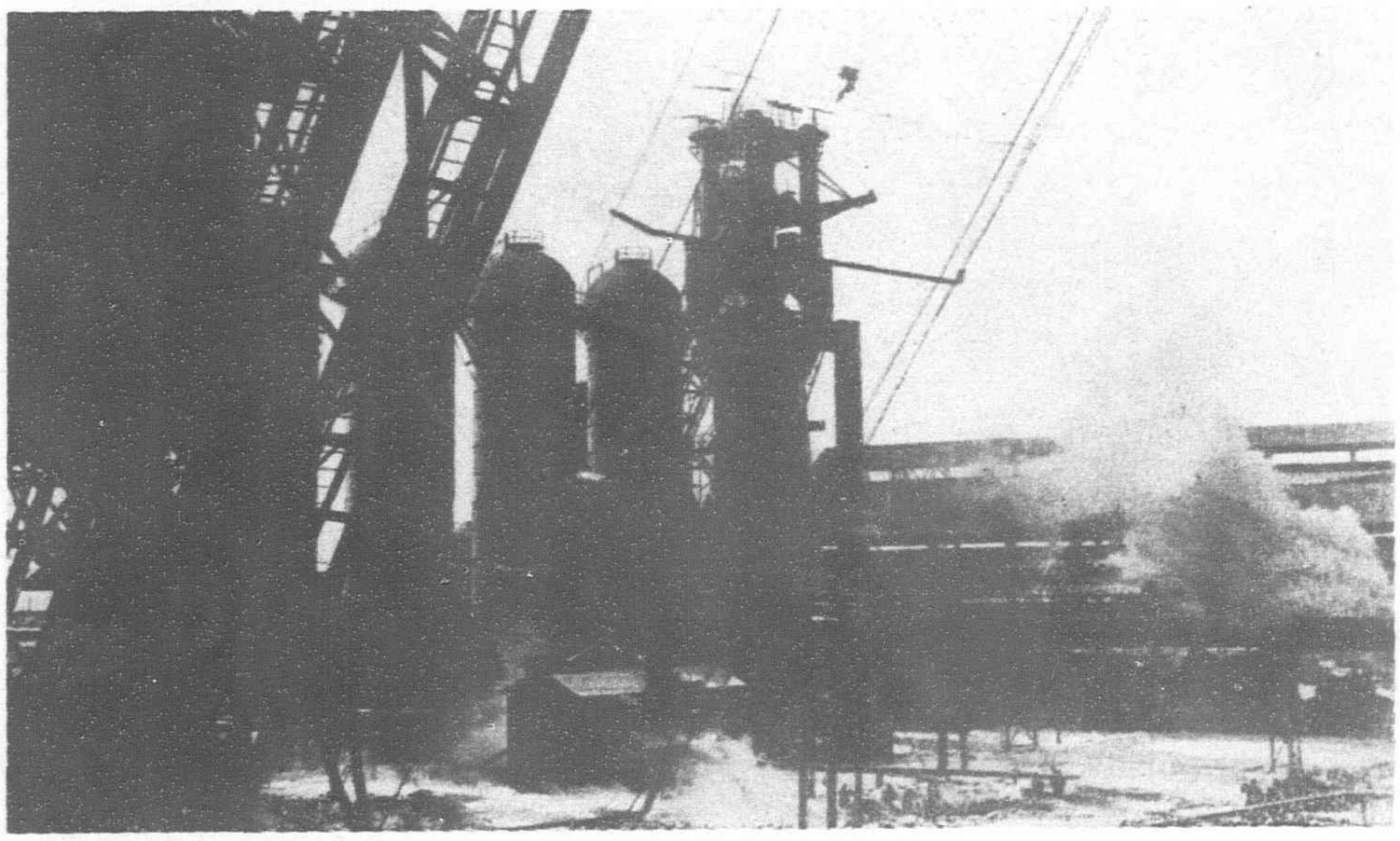
The Fuchou collieries are situated in the districts of Fuchou and Takotan, just north of the Kwantung Leased Territory. Their combined output yearly is about 380,000 tons.

The coalfield at Sian has a very promising future, its production exceeding 300,000 tons annually. With new machinery recently installed there it will soon become a leading colliery in Manchuria.

The province of Kirin possesses extensive coal veins, one of which stretches eastward from the S.M.R. main line near Sian to the N.M.R. line. A number of pits have been sunk along this zone and small amounts of coal were dug to meet local demands. But their further development has been hindered for years by competition with the great Fushun colliery. Another Kirin coal deposit is found on the upper reaches of the Tumen River. The recently completed Hsinking-Tumen Railway passes close to the newly exploited coalfield, whose future seems assured.

The best-known Kirin coal mine is located at Mulin, extending towards Mishan, with an estimated total of 100 million tons. The mine was developed to furnish coal for the North Manchuria Railway (Chinese Eastern Railway). Its current annual output is around 350,000 tons.

The former province of Heilungkiang (now divided into several provinces) is rather poor in coal resources. The Haolikang mine on the left bank of the lower Sungari is the most notable one. Its coal seam extends to Lobei on the Amur river. The mine is connected by a 75 kilometer railway with this navigable river. From only 100,000 tons in 1928 Haolikang production leaped to over 300,000 tons by 1932. In Hsingan Province lies a large coalfield north of Dalainor Lake. The recent annual output there averaged about 300,000 tons.



The Showa Steel Works, Anshan.

The Peipiao coal basin is the most important one in the southwestern section of Manchoukuo. The quality of its coal is excellent, but mining equipment is rather antiquated, in contrast to the very modern facilities available at Fushun. In the near future, with the installation of adequate machinery at Peipiao, it may become a worthy rival of Fushun.

Petroleum, Oil Shale

Sources of mineral oil have been discovered in the northwestern part of Manchoukuo, particularly in the vicinity of Dalainor. The only mineral sources so far discovered on the eastern portion of the Asiatic continent are found in Burma, the Yellow River basin in China, North-west Manchuria and in the Bureya region of Eastern Siberia. In February, 1934, the Manchuria Petroleum Company was established jointly by the Tokyo and Hsinking Governments with a capital of five million yen. The S.M.R. and other Japanese corporations are interested in the new concern, one of whose functions is comprehensive investigation for mineral oil resources in Manchuria.

Manchoukuo is becoming an important source of shale oil, thanks to the superbly equipped S.M.R. shale oil plant at Fushun. The oil shale deposit there is estimated at 5,400 million tons, of which 200 million tons will be dug out in the routine process of operating the open-cut coal mines.

The oil content of Fushun shale varies from one to 14 per cent, averaging round six per cent. The shale oil plant started operation in December, 1929, on an outlay of eight and a half million yen. It was equipped to work 1,400,000 tons of oil shale annually. Its installation has been greatly expanded during the fiscal year of 1934-35 at a further expenditure of five million yen. The bulk of the oil is reserved for the use of the Japanese Navy.

The wise utilization of the shale oil by-products is of great industrial importance. In 1930 crude oil production there reached 28,578 tons, while raw paraffin totalled 10,606 tons and ammonia sulphate 13,332 tons. By 1935 crude oil production had increased by more than threefold, approximating 100,000 tons.

Fushun shale oil production is being co-ordinated with the new enterprise in coal liquefaction at the same place. The Manchoukuo oil monopoly, another big factor in the Manchu-Japanese oil combine, that started operating a refinery at Kanseishi, near Dairen, in March, 1935, has been producing monthly from 10,000 tons crude oil 3,300 tons of gasoline and a larger amount of illuminating oil. Thereby Manchuria's import of gasoline and other refined oils were appreciably decreased.

Other Resources

There is an abundant supply of magnesia in Manchuria. Total deposits are estimated at several billion tons. The greater portion is situated along the S.M.R. zone and some rich deposits were found close to the Tashihchiao, Taipingshan, Fensui and Haicheng, totalling 384 million tons. Their joint yearly output is about 30,000 tons at present. Between 50 to 70 per cent is exported to Japan, and the rest used in the several chemical works around Dairen.

Steatite is found in large quantities near Tashihchiao and Haicheng. Its output is steadily mounting, due to increasing demand in Japan. Its 1930 production of 25,726 tons rose to 44,316 in 1932, and the bulk was shipped from Yingkou, with a lesser amount from Dairen.

Another abundant Manchurian mineral is limestone. The largest deposits are located at Choushuitzu, Huoliendhai and Penhsihu. The Choushuitzu limestone is used extensively in cement and glass making at the factories located nearby. The output from Penhsihu and Huoliendhai is utilized at the ironworks of Penhsihu and Anshan. The combined limestone output annually ranged from about 450,000 tons to 700,000 tons in recent years. Manchurian limestone is rarely found in pure form, but its total quantity is very great.

Manchurian mineral resources, so varied and rich in quantity, were little utilized up to the past few decades. The recent and rapid exploitation of minerals is due to Japanese and Russian initiative and enterprise. The tardy development was mainly due to the past political insecurity of the country, which held back the influx of abundant foreign capital for many years.

After the Japanese acquired military and political ascendancy there following the 1931 incident more than 770 million yen were newly invested in Manchuria during the following four years. About two-thirds of this immense capital was invested in industrial enterprises. Therefore, it may take several years yet before the full effect of the new investment becomes discernible in large

(Continued on page 125)

The Canton-Hankow Railway*

By H. H. LING, Managing Director, Canton-Hankow Railway

On April 28, 1936, with the last piece of rail laid, China had completed one of her trunk lines, *i.e.* the Canton-Hankow Railway. Although but recently completed, the Canton-Hankow Railway is nearly forty years old if reckoned from the early days of its promotion. During his school days the writer, who was responsible for finishing up the middle four-tenths of the line, was among the many who paid the first dollar out of a five-dollar bond share to redeem the railway from the hands of an American syndicate some thirty years ago.

After a suspension of thirteen years, work on the remaining section from Chuchow, Hunan, to Shaochow, Kwangtung, a distance of 456 km., was resumed in 1929. Owing to the lack of sufficient funds, it was only possible for the Construction Administration to proceed from Shaochow to Lochang, a length of 50 km., which was completed and opened to traffic in 1933. In July 1933 an agreement was entered into between the Ministry of Railways and the Board of Trustees administering the Sino-British Indemnity Funds, whereby a loan of £1,660,000 was made for the purchase of materials from Great Britain and $30,000,000 was for labor and local materials for the completion of the remaining 406 km. of this railway. A definite source of funds having been provided, work was immediately pushed ahead in July 1933, from Lochang northward and from Chuchow southward, with Construction Headquarters at Hengchow, just midway between Canton and Hankow. Although it was estimated that four years would be required for its completion, it took only about three years after the resumption of work. On July 25, 1936, the first train ran over the whole line, but for local reasons the first through passenger train did not run until September 1, 1936.

Engineering Problems

The construction of this middle section presented engineering problems of variety and interest, for, along the line, we encountered flat regions where level tangents could be projected for several kilometers and very hilly country where 65 per cent of the road is on curves ; wide river crossings with sandy beds and deep gorges with rock foundations ; cheap and readily available materials and expensive supplies with prohibitive cost of transportation ; cheap but industrious laborers and high pay, but inefficient workmen ; different languages and technical terms, different currency standards, different climates, and different modes of living.

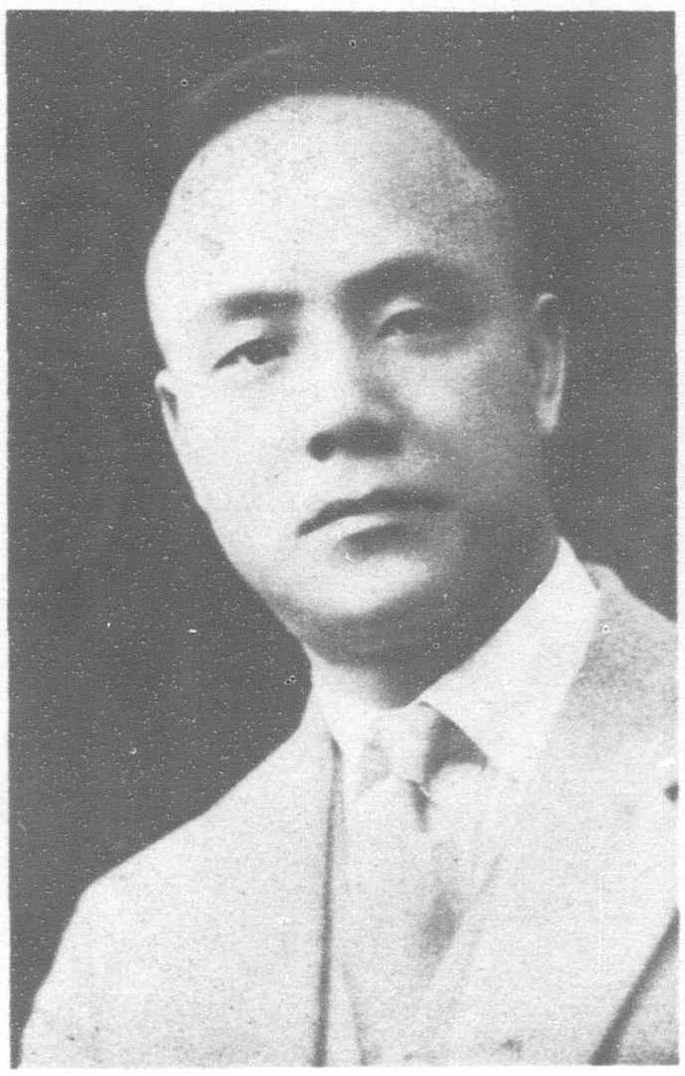
The stretch of about 120 km. from Lochang to Chenchow, Hunan, over the provincial divide is probably the most difficult section of the whole of the Canton-Hankow Railway. The original survey called for 66 tunnels, but subsequent studies placed the alignment along the upper reach of the North River and reduced the number of tunnels to 14, the longest of which is only 300 m. The quantity of rock cutting in this short section alone amounted to 3,000,000 cu.m. The amount of dynamite used for blasting was over 2,000 tons, while the number of workmen employed for the whole section once reached 184,000. Due to the steep side slope of the banks and the deep gorges of the North River, which has many rapids, the transportation of construction equipment and machinery is extremely difficult. Only light and portable machines could be used to advantage.

Stream crossings of this short section are mostly of shallow water with solid rock bottom and very high banks which necessitate very high bridges, such as 30-m to 40-m. high piers for steel bridges.

The northern section from Chuchow to Hengchow, 130 km. in length, passes through a rolling country with much lighter construction. This section crosses three big streams which necessitate three major bridges, the Lo-Ho bridge of 4.45 m. through trusses and 7-18 m. deck plate girders, the Mi-Ho bridge of 2-45 m. through trusses and 14-18 m. deck plate girders, and the Lei-Ho bridge of 4-60 m. through trusses and 8-18 m. deck plate girders.

Technical Standards

As to the alignment, it was decided to use 0.7 per cent maximum grade and 300-m. radius minimum curvature for the section from Chuchow to Chenchow and a maximum grade of 1.5 per cent with compensation for curves from Chenchow to Lochang. At the final location over this difficult section a line was found with broken 1 per cent maximum grade uncompensated for a length of about 3 km. on both sides of the divide and congregated within a distance of 20 km. on the Hunan border. The maximum curvature is 4°-45-ft. (20-m. chord), thus making the maximum grade 1.285 compensated. The length of this particular curve is about 500 m.



H. H. Ling, Director and Engineer-in-Chief of the Canton-Hankow Railway, and Author of this Article.

Chinese National Railway standard section rails of 43 kg. per meter and 12 m. long are used. Bridges, both the steel structures and the masonry work, are designed for Cooper's E-50 loading. The roadbed, tunnels, minimum clearance, etc., are all in conformity with the standards of the Ministry of Railways. About 50,000 tons of rails and accessories, 6,000 tons of bridge steel and 525,000 barrels of cement were used for this 406 km. of line. Due to climatic conditions and the abundance of white ants ordinary wooden sleepers are not suitable on this section, so about 120,000 creosoted Canadian pine sleepers 6-in. by 9-in. by 8-ft. were purchased. Creosoted soft-wood sleepers cannot be used to advantage nor economically without the use of steel tie plates, and, as creosoted sleepers plus tie plates were found to be more costly than hard-wood sleepers, Australian Jarrah wood sleepers of 5-in. by 9-in. by 8-ft. were afterwards more extensively used. Besides, about 60,000 native sleepers, such as local pine and Hunan *san* wood, were used for the sidings, making up a total of about 670,000 sleepers.

Rolling Stock

For this section the Ministry of Railways purchased 24 locomotives of the 4-8-4 type suitable for traffic through the whole line with a tractive effort of 17,500 kg. each and capable of attaining a speed of 80 km. per hour on level track and of hauling 1,000 tons at a speed of 25 km. per hour up a one per cent grade. Other rolling stock purchased consists of four shunting engines, 160 steel covered wagons, 175 high side wagons, 90 flat wagons, all of 40-ton capacity, five first-class sleeping cars, five second-class sleeping cars, five second-class day coaches, 20 third-class sleeping cars, five dining cars, five baggage cars and one mail car.

As the completion of the Chuchow-Shaochow section was approached, extensive rehabilitation and strengthening work was done on both the Wuchang-Chuchow and the Shaochow-Canton sections, which for one reason or another had become somewhat dilapidated, and certain structures had to be replaced and many sleepers renewed to take care of present-day traffic. These improvements were timed to be completed at the same time that the new section was ready for traffic, so that when the Chuchow-Shaochow section was finally declared open there was a first-class trunk line all the way from Wuchang to Canton.

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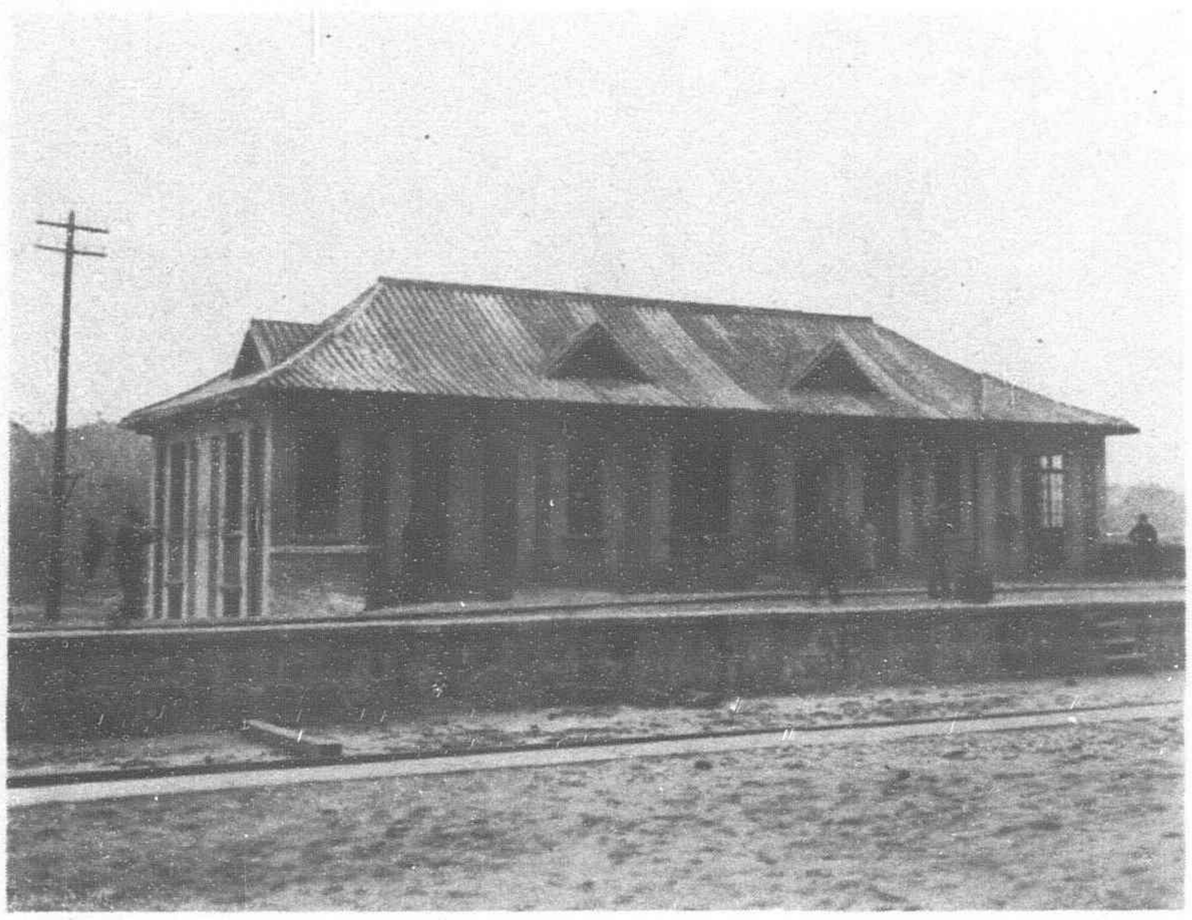
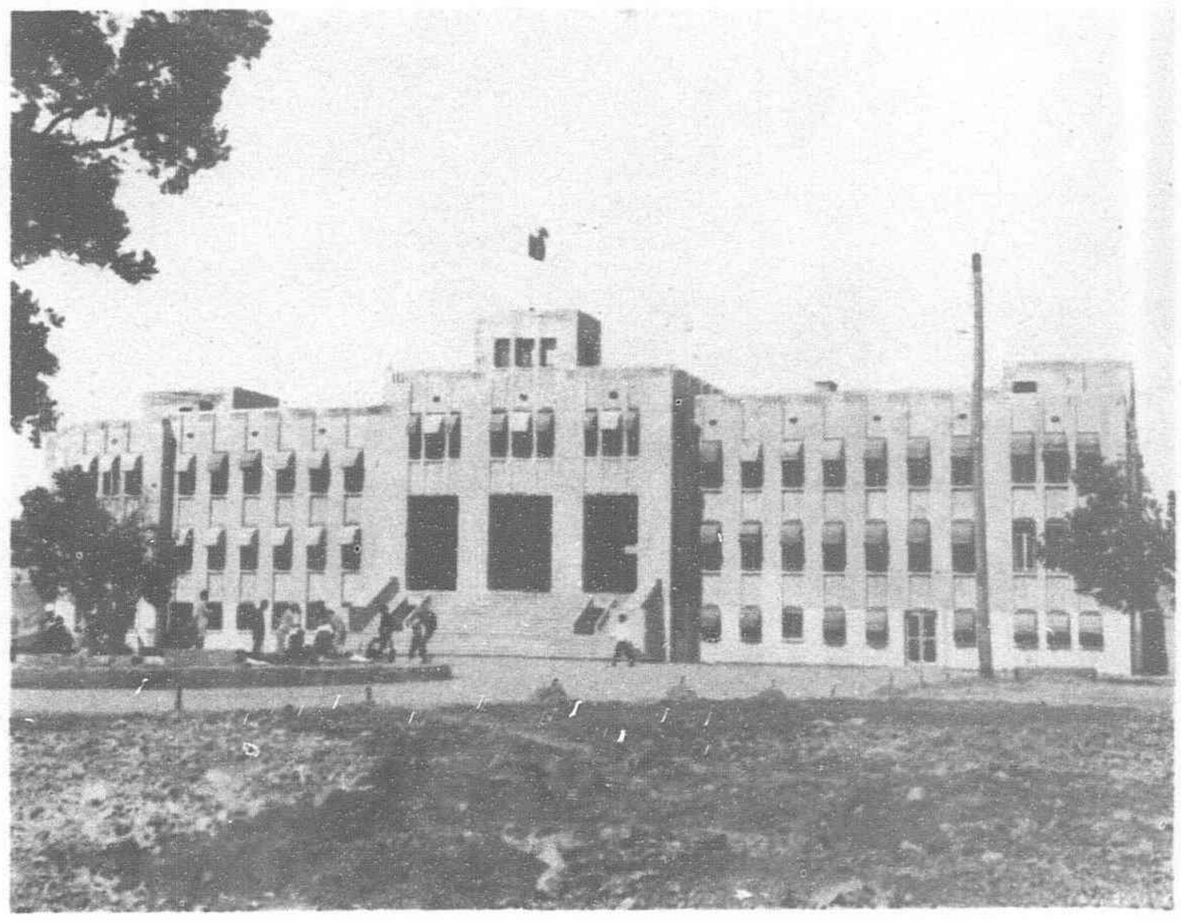
* *Jowrnal of the Association of American and Chinese Engineering*



Typical third-class station building on the Canton-Hankow Railway



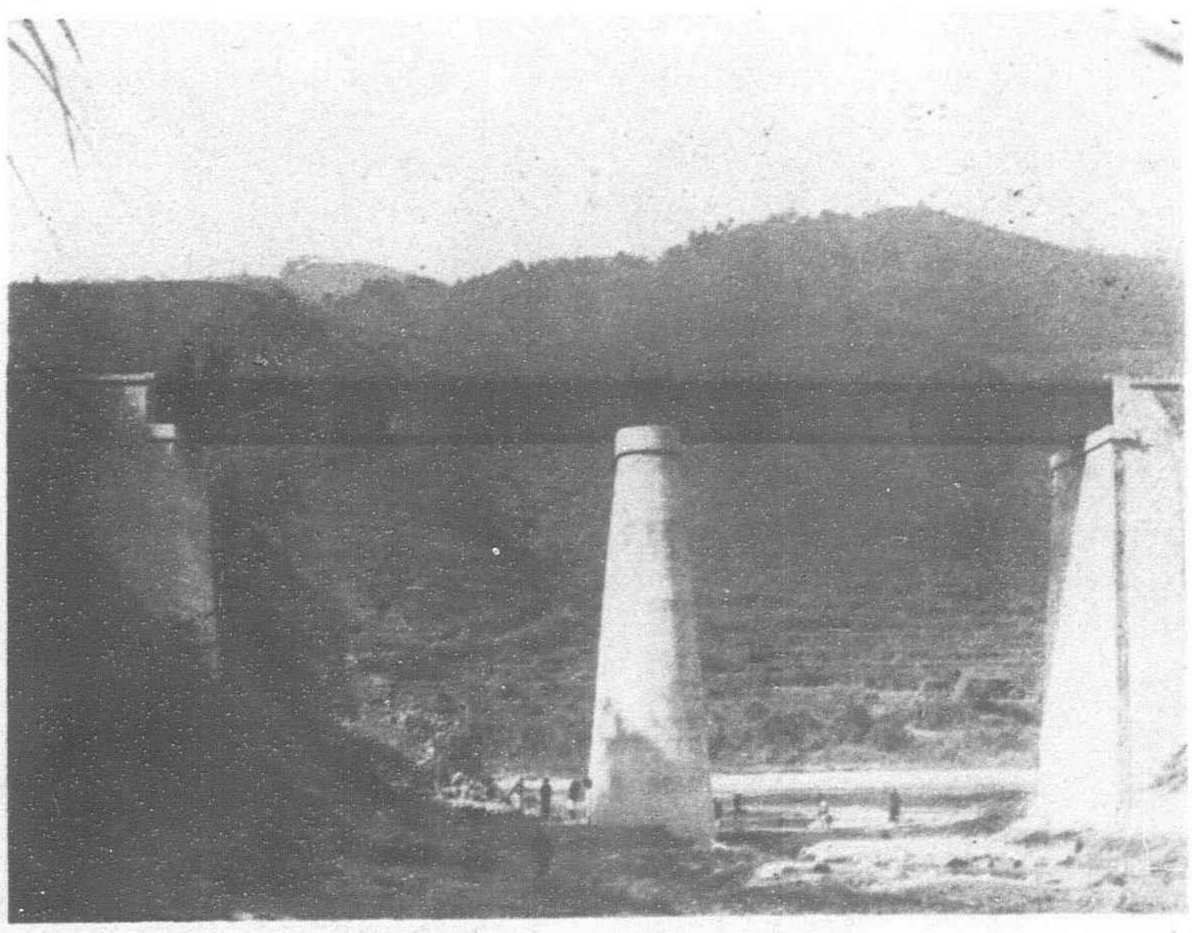
Hengyang Station Building

The completion of the Canton-Hankow Railway is one of the great undertakings of the National Government during recent years, and it is worth noting here that it was finished well ahead of time. First, a careful choice of the route across the provincial border was a great contribution to the success of the project, as the final location called for only 14 tunnels instead of 66, thus saving much time and about 4,000 m. of tunnelling which would have cost about $4,000,000. The final location also improved the grade materially by using 1 per cent instead of 1.5 per cent as maximum, thus greatly facilitating transportation and operation. Secondly, the Administration had all the difficult work started early by tackling the Lochang-Pingshek section first, resulting in the completion of all the tunnels and bridges sufficiently ahead of time for track laying. Thirdly, besides working from both ends, work was also started simultaneously from the central point at Hengchow by making use of the Hsiang River for transportation of materials, resulting in much gaining of time, with corresponding higher cost of transportation.

Suggestions for Future Work

In view of the extensive railway-building program to be carried out in China in the next few years, and considering the heavy expenditure of capital on one hand and the scarcity of funds on the other, the engineering profession of China is confronted with the important problem of planning what can be done to effect the rapid construction of railways with the limited funds which are available. By virtue of past experience the following points may be offered to the technical men concerned with the attainment of such a goal.

Careful Selection of Route.—Before the construction of a railroad, a careful study on the selection of the most logical route is of paramount importance. Not only well-experienced engineers should be called to make thorough studies, but also ample time must be given. The engineer is not always responsible for ill-advised, hasty work. He should make earnest representations and even strenuous demands that he be given the requisite time, opportunity and money to conduct his surveys in such a manner as to investigate thoroughly every possibility for choosing the best route. This will be found particularly important when the development of Chinese railways is toward the Southeastern Provinces, where the general topography makes construction difficult.



One of the bridges on the Canton-Hankow Railway

Technical Standards.—The question of technical standards such as grade, curvature, rail section, roadbed width, bridge loading, etc., deserves careful consideration, and those should be adopted which suit the physical and economic conditions of the line. Owing to the difference in time of construction and first cost between some railways that use much lighter standards and those adopting the Ministry of Railway standards, public sentiment seems to be influenced by the faster and cheaper construction of the light railway. From an engineer's point of view this is not what the construction of a railroad is after. The use of too light a rail section and bridge loading, and a narrow roadbed, undoubtedly involves low initial cost and shorter time in construction, but necessarily limits the capacity of the railroad as a means of transportation. Nevertheless, there may be circumstances that call for lighter standards than the Ministry's, and the engineer in charge will have to decide on that. In general, we may say that:

(1) Curves should not be sharper than 5-degrees metric on the main line, while the grade may vary according to circumstantial needs, with an upper limit preferably not higher than 1.5 per cent.
(2) Rails should not be lighter than 65-lb./yd.
(3) Bridge foundations should be designed for Cooper's E-50 loading, while the superstructure may be of E-35 loading.
(4) Roadbed should not be narrower than 5 m.
(5) Sub-grade must never be below the highest flood level.
(6) The number and capacity of culverts should not be so economical as to sacrifice their purpose.

Selective Purchasing of Materials.—The cost of materials occupies a big place in a railroad's construction budget. The importance of the subject should not be overlooked, as nearly 90 per cent of the materials must be purchased abroad. For the present, at least, most of the construction funds come from sources which have a clause governing the purchase of materials. This, of course, hampers us from buying in the field of international competition. However, it does not mean that the market within a certain designated country is closed to selective buying. We still can get the best and cheapest. But we must send out own men to acquaint themselves with the market conditions, and appoint technical personages to inspect all the materials before

acceptance. In this way, not only the miscellaneous charges and consultation fees can be saved, but also we can have our own specialists trained up. As for such materials as we shall need in large quantities, we must send men to look for the respective market, lest only a few concerns monopolize when the need is urgent.

Contracting of Work.—In railroad construction, besides having sufficient funds and an able engineering staff, there must be good contractors. However, as contracting in this country is still in its infancy, it is usually hard to find many contractors with enough capital and experience for railraod construction. And as for the few who are really capable to do the job, it is still difficult to get them to bid on work in places where skilled labor, money and transportation facilities are mostly lacking. With the addition of local uncertainties it is well-nigh impossible to find a good contractor, unless the margin of profit is quite attractive. This necessarily leads to a higher unit cost than for work done in or near the big cities. Under these conditions, the engineer-in-chief must handle the situation very carefully. He should not necessarily choose the lowest bidders, but should usually look into the difficulties of the capable contractors and try to help them when needed. For certain kinds of work in the interior where large contractors are not available, the engineer should always secure some small but efficient contractors who can do good and expedient work but are lacking in financial facilities and equipment. These contractors usually do very good work at a reasonable unit price if the amount of work given is in accordance with their respective abilities. The Canton-Hankow Railway Construction Administration adopted this method with much satisfaction.

Tumen-Chiamussu Railway Completed

(Continued from page 111)

Placer mining in the Chiusha River is also supposed to be worth exploiting.

To top all these, the construction of a good road to Paoching, nearly 110 kilos. to the northeast, is under contemplation.

Town Plan

The Public Works Office of the Poli Prefectural Government has now taken in hand the execution of a town plan on a three year program. The new town site, having the railway station in the center, will be divided into commercial, industrial, and residential sections, with a circle, a park, a recreation ground and other areas for public use.

The wild level tract stretching beyond the existing small town in front of the railway station will be converted into a modern city of decent size.

The walled town of Poli is about two kilos from the railway station. The means of conveyance available is Peking carts, of which there are about a hundred.

As the gates of the walled town are closed and barred at sundown for the night, travellers stranded at the railway station when the train is late will be hard put to it for a night's shelter.

The inn accommodation is of the crudest imaginable, and now Poli has risen to be a stop over station, it is up to the town to provide more comfortable accommodation for an increasing number of incomers and outgoers.

The walled town has been lit by electricity since the beginning of the year as if to herald the influx of modernity.

Poli, with all its crudity, takes a just pride in possessing a financing union, which facility is still denied to Mutankiang and Chiamussu. This union like its kind elsewhere, functions to finance in a small way petty retailers and workshop people.

The Union owes its existence to Mr. Kidani, chairman of the Japanese Residents' Council. Anticipating the need of such a union, he organized one as early as March, 1936, on the modest capital of G.Y10,000 in shares of G.Y50 each, paid up in full. Its loans now amount to G.Y16,000 as against G.Y8,000 in deposits. It distributed 20 per cent dividend for the first working year, and, as it is growing in business, it faces the necessity of increased capital, and has approached the Central Bank of Manchoukuo, Hsinking, for a low-interest loan of M.Y30,000.

Of late, applications for loan service are being received from the Manchu side, too.

The sound businesslike style in which the union is managed is building up the good reputation it deserves.

Manchuria's Mineral Resources

(Continued from page 122)

quantities of new goods produced in the country. The bulk of the new enterprises were dictated by the national policy of Japan, and less by private initiative.

The huge amount of money that Japan has poured into Manchuria in the past few years may appear too great and sudden to distant observers, but there is no doubt that the outlay will yield important results for the industrial future of Nippon.

Manchoukuo Industrial Program

The Manchoukuo five-year industrial development plan to exploit the natural resources and increase the production of that country, has been completed. The capital requirement is Y.1,500,000,000, to be raised as follows: Y.600,000,000 by the issuance of bonds by the Manchoukuo Government; Y.300,000,000 by the South Manchuria Railway Company; Y.400,000,000 by Japanese capitalists, and Y.200,000,000 by formation of a new financing organization. The plan, which is divided into the three major categories of heavy industry; agriculture, livestock and forestry; and communications, river improvement and civil engineering. Success of this large program, however, is considered doubtful. A news agency reports, because Japanese capitalists are against making further large investments in Manchoukuo. Details of the program follow:

(1) Manchuria Coal Mining Company, consisting of all coal mines in Manchoukuo other than the S.M.R. Fushun collieries, will increase its capital to Y.80,000,000. The railway company will help this company to increase output to 20,000,000 tons a year.

(2) The Manchoukuo Government will give full support to the Sungari River hydro-electric power generation enterprise, to be started shortly with a capital of Y.10,000,000 to supply cheap electric power for industrial development.

(3) National road construction involving expenses of Y.100,000,000 will be undertaken for development of agricultural and mountain districts. The total length of roads is estimated at 60,000 kilometers.

(4) River improvement will be undertaken with a fund amounting to Y.100,000,000. A great canal connecting Mukden and Newchwang will be excavated, utilizing the Liao River. The Sungari River also will be improved, and the Taling River's embankment will be undertaken.

(5) Production of soya beans, wheat and rice will be increased. More than 10 agricultural experimental stations will be established in North Manchuria.

In co-operation with the railway company, the Manchoukuo Government will also concentrate its energy on development of heavy industry and livestock and forestry enterprises.

Great Yangtze Bridge

A report from Hankow states that a tentative project for the construction of an iron bridge across the Yangtze River, involving an estimated outlay of over $10,000,000, has been drafted. The main purpose is to provide a direct link between the Canton-Hankow and Peiping-Hankow Railways, and to facilitate communication between the cities of Wuchang, Hankow and Hanyang. Preliminary plans worked out by Mr. Mao Yi-sheng, Engineer-in-Chief of the Chientang bridge at Hangchow show that one end of the new bridge will be at Hankow, and the other at a point between Snake Hill in Wuchang and Turtle Hill in Hanyang. Besides rails for train transportation, the bridge will have roads for motor vehicles and ricshas and pavements for pedestrians, and the span will be high enough to allow the biggest river steamer to pass under it. The project also allows for the construction of two smaller bridges to ease congestion of traffic.

Engineering Notes

RADIO AND TELEPHONE

LONG DISTANCE TELEPHONE.—Hunan and Anhwei provinces were brought nearer together when the Changsha-Wuhu long distance telephone service was formally inaugurated recently, tolls for each call being fixed at $2.80. The Changsha-Wuhu line is a component part of the Nine-Province Telephone Network, which comprises the province of Kiangsu, Chekiang, Anhwei. Kiangsi, Hupeh, Hunan, Honan. Hopei and Shantung.

CHINA AND P.I. RADIOPHONE.—The installation of the radiophone between China and the Philippines has been completed, and tests are now being made. It is expected that the service will be opened soon, says a Nanking message. Radiophone service between China and Great Britain and between China and America may not be in operation as soon as desired. The exchange of legal documents pertaining to the arrangements is causing the delay.

CANTON-SHANGHAI RADIOPHONE.—Following successful tests recently, arrangements have been concluded for the inauguration of a radiophone service between Canton and Shanghai in mid-December. When this service is opened, Hongkong telephone subscribers will be able to communicate by radiopone to over ninety per cent of the 40,000,000 telephone subscribers in the world. It is said that an extraordinarily cheap rate will be charged for conversations between the Colony and Shanghai.

INDUSTRY

NEW PAPER FACTORY.—Order for the construction of the largest modern paper mill in British India has just been placed with the German firm Maschinenfabrik A.G. in Bad Warmbrunn. The cost of the new factory, which will have a daily capacity of 20 to 25 tons of paper, is estimated at £100,000.

MANCHOUKUO STEEL.—The Showa Iron Works at Anshan, described as the largest steel plant in the Japanese Empire, announces plans for enlarging its capacity. In 1935, 650,000 tons of pig iron and 350,000 tons of steel were produced by the company. It has been decided to increase the output by 150,000 tons of each, so that the total will reach 1,300,000 tons.

JAPANESE PAPER MILL.—According to Chinese reports from Tientsin, some Japanese industrialists have decided to establish a paper manufacturing company in Tientsin.

The same reports state that the company in contemplation will be capitalized at Y.10,000,000 and will be inaugurated in Tientsin some time in 1937.

HYDRAULIC LABORATORY.—To facilitate research in water conservancy in Hupeh, the Central China Hydraulic Laboratory is being constructed in Wuchang under the joint auspices of the Hupeh Provincial Government and the Wuhan University.

It is expected to be completed before the end of the current year and its construction cost is estimated at $75,000.

ALUMINIUM PLANT EXTENSION. Using 100,000 kw. of electric power, Japan Electric Industry Company plans the production of 50 metric tons of aluminium a day. The Communications Ministry has been applied to for permission to build the power plant. The enterprise would take three years to complete. Incidental to it, the company would develop several points along the Hime River, the Chikuma River and the Sai River in Nagano Prefecture.

MOTOR INDUSTRY.—Under the protection of the Automobile Industry Law, Japanese industrialists, are planning the establishment of four automobile factories. Negotiations are under way for a Franco-Japanese factory. The Nissan company has decided upon a six-cylinder car standard for both passenger cars and trucks as a result of negotiations with the Chrysler Corporation for purchase of a licence for using the Graham design in the manufacture of Nissan cars. Preliminary models are now being constructed at the Graham factory at Detroit. Another group connected with the Renault Automobile Company in France are investigating joint investment with Japanese industrialists for establishment of a factory, using the six-cylinder, 40-horsepower Renault car as a model.

INDUSTRIAL LABORATORY.—Establishment in Japan of a Y.6,000,000 machinery testing and research laboratory to raise the technical standards in the manufacture of tools and engines for automobiles and airplanes to the level of foreign products is sought by the Japanese Minister of Commerce and Industry. At present there are only two Government-operated industrial testing laboratories. Efforts to enforce the new automobile law are said to have revealed the inadequacy of present equipment. The new plan calls for control of the laboratory by the Ministry of Commerce and Industry, with a private engineer to fill the post of director. The laboratory would certify the function and precision of machinery and automobile, airplane and machinery tools.

AGRICULTURE EXPERIMENT STATION.—An agriculture experiment station will be opened in Tientsin in the near future by the Tokyo Ministry of Foreign Affairs. The plan was decided upon some time ago as a measure to start Sino-Japanese co-operation in relief of the people in farm villages in North China. It will give them technical aids and scientific direction for the improvement of agricultural products. The head of the station will be Mr. M. Fujiye, President of the Chunichi Gakuin or the Sino-Japanese Institute. Several experts on agriculture will be invited from Japan to engage in the scientific study.

MANCHU SODA.—Foundation of the Manchuria Soda Company is announced. The company will have an authorized capital of Y.8,000,000, half paid. The company is to start erection of a factory at Kanseishi, near Dairen, immediately. Establishment of this concern has been in doubt since 1934, due to conflict of interests. At one time it was believed that plans had been abandoned. The new concern will receive its supply of ammonium from the Manchuria Chemical Industry Company, and will produce 100 metric tons of soda ash a day. It expects to start manufacture in July of next year.

ELECTRICAL

NEW POOTUNG POWER STATION.—To meet the steadily increasing demand in Pootung, the Pootung Electric Supply Co., Ltd.,is now formulating plans for the erection of a modern power station consisting of two 5,000 kw. turbo-generating sets. A site of over 70 now at Wang Kai Doo, Pootung, has been secured for this purpose. Tenders are now invited for the above plant. The construction of the buildings will be commenced early next year and the installation work is expected to be completed in the course of two years.

POWER INDUSTRY.—The Minister of Communications of the Japanese Government has approved a plan for the State control of the electric power industry through an electric generation and transmission company, which is to be organized shortly.

This new State company will have a capital of Y.2,000,000,000 (£116,000,000 approximately), and will take over control in 1938.

The new national company will take over all the existing electric power companies. Its capital will be provided by the existing companies, and no Government investments will be necessary, apart from advances from Government funds. It is estimated that the cost of electric power will be lowered 20 per cent through its operations.